

Public Review Draft

Urban Forest Management Plan



City of Seattle
September 2006

Vision

Seattle's urban forest is a thriving and sustainable mix of tree species and ages that creates a contiguous and healthy ecosystem that is valued and cared for by the City and all of its citizens as an essential environmental, economic, and community asset.

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Executive Summary: TBD

Introduction

Purpose of the Plan

The purpose of the Urban Forest Management Plan is to guide a broad range of actions that will achieve a sustainable urban forest in Seattle. This is a 30-year plan that recommends the steps the City of Seattle must take to preserve Seattle's trees and the cherished environment we have come to call "a city among the trees."

What is the Urban Forest?

Stated simply, Seattle's urban forest consists of all trees in the city on both public as well as private property. This forest includes street trees, park trees, forested parklands, trees on institutional campuses, and trees in many private ownership settings. The urban forest touches the lives of Seattle's citizens every day. Whether it's enjoying a hike through old-growth forest in Seward Park or the fall colors on a drive along Lake Washington Boulevard, it is trees that comprise the urban forest and trees that make the experience magical.

Why is it Important?

Trees located throughout Seattle on public and private property affect our lives and the local economy in ways that aren't always obvious. Trees provide community, environmental, and economic benefits that range from reducing the effects of density to increasing property values to providing ecological services such as stormwater mitigation, air toxics removal, and greenhouse gas sequestration.

The Decline of Seattle's Urban Forest

Seattle's urban forest has significantly declined over the last few decades. Since 1972, Seattle has lost more than half its tree canopy cover, which experts consider the best index for the benefits trees provide urban areas. Currently, only 18% of the city is covered by tree canopy as compared with 40% just 35 years ago. While the primary loss of tree canopy is due to development, other reasons have also been a factor as will be discussed later. The loss of the treed relief in a built-up city reduces livability.

Planting Trees

The City of Seattle has worked to stem the loss. Over time the City has planted thousands of trees during restoration projects, as part of Capital Improvement Program (CIP) projects, and as replacements for trees that were removed. Today, over 125,000 trees are under the City's care in developed areas (including 35,000 of the 130,000 street trees and 90,000 trees in developed parklands) and hundreds of thousands more in natural areas.

The City also creates incentives for private tree planting through programs like the Neighborhood Matching Fund as well as requirements for preservation through our development regulations.

Seattle's First Comprehensive Urban Forest Plan

While having a positive impact, these efforts have not been enough to preserve Seattle's urban forest. A resource of this magnitude requires careful management to ensure its preservation, restoration, and enhancement. For that reason, the Urban Forest Management Plan has been developed as a roadmap for the long-term management of Seattle's trees.

Managing trees in a city differs from managing forests in natural settings. Urban forest management goals such as increasing tree canopy, improving public safety, and providing native habitat and recreational and educational opportunities must be balanced with other goals such as accommodating growth and facilitating transportation. The Urban Forest Management Plan is the City of Seattle's plan to integrate management of the many issues and opportunities posed by Seattle's tree resource.

Additionally, all natural systems change over time. If we want these changes to enhance the urban forest, they must be actively managed. Nationally-based studies repeatedly support the fact that the resource deteriorates when human intervention is not a proactive part of urban forest management. This decline can be seen in many of Seattle's greenbelts where ivy is strangling trees and preventing native species from growing because historically these areas were considered 'natural' and did not require maintenance. It is also evident where trees are planted in places that either don't allow for growth or that conflict with power lines. Proactive management is needed to keep our trees sustainable and in balance with other urban priorities.

Organization of the Plan

The Urban Forest Management Plan is organized into the following sections:

- Urban Forest Sustainability
- Seattle's Urban Forest Today
- Recommended Goals and Actions
- Goals and Actions by Management Units
- Moving Forward: Implementing the Plan

1. Urban Forest Sustainability

The primary goal of the Urban Forest Management Plan is to preserve, restore, enhance and sustain the urban forest over the long term. Therefore, we must consider how the resource has been managed in the past, what its value is, how the resource can be sustained over time, and what set of actions will move us toward our goals. In this section, we discuss the history and value of the city's trees, the model used to shape this plan, and outcomes we expect to achieve.

1.1. A Short History of Seattle's Trees

The first European settlers to our region were awed by magnificent old-growth forests that seemed unending. Trees soon became the business of the new city with millions of board feet of lumber milled for local use or shipped to San Francisco and other ports to feed the needs of a growing nation.

The ecological impact of logging over time was enormous. Native soils were significantly disturbed, streams and the life they supported were also significantly altered, and many acres of forest lands were incrementally covered by the building footprints of the new city. Perhaps the most significant impact of early logging operations was that no seed source remained to allow second-growth forests to be repopulated with conifers. Instead, over 70% of Seattle's new forest seeded in with short-lived native maples and alders. Today, the City of Seattle owns more than 3,200 acres of these second-growth forests and most are in serious decline. In a city land-base that once enjoyed more than 53,000 acres of old-growth conifers, only slightly more than 200 acres of true old-growth forest remain today.

From a Land of Giant Trees to an Urban Forest

In the 1820s David Douglas observed,

"The Douglas fir wilderness of Western Washington and Oregon, covering 55,000 square miles, was one of the treasure chests of the nation. Mile on mile, county on county, it stretched from level bay to high-hipped mountain, from river canyon to lava ridge, carpeting shoreland flat, valley and peak with an almost unbroken mantle of green".

The urban forest contains all the trees in the city. Over time, many trees have been planted within the built environment as well as in forested parklands. The following are highlights of this effort:

- In 1884, Seattle dedicated Denny Park as its first City park. Since then, the park system has expanded to over 6,300 acres—12% of the city's land base. Today, Seattle's developed parks and boulevards contain an estimated 90,000 trees. Seattle's remaining forested parklands contain an estimated 550,000 to 600,000 trees.

- In 1903, an ordinance was passed that authorized the Superintendent of the Board of Public Works to improve the “parking” strips along Seattle’s streets. Local Area Improvement Districts were formed to build, plant, and maintain street medians in many neighborhoods. As a result of these actions, Seattle now has over 135,000 street trees, 35,000 of which are directly maintained by the city.
- Also in 1903, the Board of Park Commissioners hired the Olmsted Brothers Landscape Architecture firm to develop a plan for a citywide park system. The Olmsted proposal recognized existing parks, recommended areas for future acquisition as either a developed park or natural area, and designated a system of connected boulevards and scenic roads. In 1908, the City received their “A Comprehensive System of Parks and Parkways” report: now commonly referred to as the “Olmsted Plan.”
- Following the Alaska-Yukon-Pacific Exhibition in 1909, a new Municipal Plans Commission was formed to work with the board to consider land acquisition. The commission hired Virgil Bogue, a world-renown engineer who had worked previously on projects directed by Frederick Law Olmsted. Bogue proposed creating a civic center at Fourth and Blanchard. In 1927, the first phase of construction began on what would become the 87-acre Seattle Center campus.
- In 1959, a Citizen Advisory Group planning for the 1962 Seattle World’s Fair proposed planting street trees along Third, Fourth, and Fifth Avenues with trees from the Central Business District to the Seattle Center fair grounds. Weyerhaeuser donated the trees to the City, who charged the City Engineer with their planting and maintenance.
- In 1967 “Operation Green Triangle” was approved as part of the King County Forward Thrust Bond measure. This led to street beautification, including over 50 “triangles,” throughout the city. Since then, street trees plantings have been funded by federal block grants, state grants, and City initiatives. City efforts include the Urban Tree Replacement Program at Seattle City Light, the Millennium Woods Legacy Project, and the Department of Neighborhoods Fall Tree Fund.
- In 1989 Seattle voters passed the \$41 million “Open Space Bond Measure.” By 1998 the original \$41 million had been leveraged with other fund sources to about \$100 million allowing Seattle Parks and Recreation to acquire nearly 600 acres of openspace properties, to be maintained in a natural state in perpetuity.
- In 1994 the City allocated funds from the Cumulative Reserve Fund (CRF) for the purpose of restoring forested parklands. This action was important for several reasons. For the first time trees were identified as city infrastructure assets. This made forest restoration eligible for CRF funding. This action resulted in Park’s successful Forest Restoration Program.
- 1994. Seattle’s first Heritage Tree, a Japanese Umbrella Pine, is recognized by City Council at the Curry Temple, 172 - 23rd Avenue.

- In 1999/2000 Seattle very successfully implemented the Millennium Woods Legacy Project, which resulted in the planting of nearly 26,000 new trees throughout the city on both public and private property.
- In 2000 the Pro Parks Levy was passed by Seattle voters. The levy contained funding for a third tree crew in Parks, creation of an Urban Forest Crew Chief position to supervise all parks tree crews, and a 3-person Natural Area Crew dedicated to maintenance work within forested parklands.
- In 2001 the Seattle City Council passed, and the Mayor signed into law, a Tree Protection Ordinance number 120410, which applies to trees on undeveloped land and allows for the added protection of trees during development.
- In 2001 Dutch Elm disease was discovered in Seattle.
- In 2004 the Green Seattle Partnership was formed. The partnership is collaboration between the City and the Cascade Land Conservancy with the single goal of restoring 2,500 acres of forested parklands by the year 2025.

1.2. Environmental, Economic and Social Value of the Urban Forest

Sustainability can be defined as the maintenance of environmental, social, and economic functions over time. In this section, we discuss the value of Seattle's urban forest.

Environmental Values

We know that Seattle's urban forest is home to wildlife. Within Park-owned properties alone, more than 250 terrestrial vertebrate species (8 amphibian, 7 reptilian, 225 avian and 21 terrestrial mammalian and 10 marine) are known to occur.¹ The trees found in Seattle's forested areas and watersheds provide valuable habitat. At the same time, trees provide shade that cools streams, intercepts rainwater and lessens the impacts from storm events. As a result, fluctuations in stream flows are reduced and stream water quality is improved, which positively affects fish and other aquatic life. Thus, trees provide both terrestrial and aquatic habitat value. Even the trees found in very urban settings can provide some of these benefits.

An aerial view of a typical Seattle residential neighborhood reveals another interesting environmental benefit. Homeowners tend to plant the back of their property more heavily. When viewed from above, the connected properties often form rather substantial linear

Green Infrastructure vs. Global Warming

When seen from space, Seattle is quilted with streets, building roofs, parking lots, patches of trees, boulevards, parks, and waterbodies. Collectively, the planted ('green') component of our city influences air and water temperatures, air and water quality, and surface water runoff. Our green infrastructure is an important means of reducing global warming.

¹ Seattle Department of Parks and Recreation, "Urban Wildlife and Habitat Management Plan," July 1994, Gregg Miller.

forested stretches that provide added habitat and connectivity.

In addition to making our city more livable for a growing population, Seattle's urban forest provides habitat to a variety of wildlife and native and migratory songbirds. Specific programs like the Backyard Wildlife Sanctuary Program administered through Washington State Fish and Wildlife encourage urban stewards to create habitat that supports dwindling urban wildlife populations. Typically this involves an emphasis on planting native plants. In general, there has been a trend in the Seattle area for a number of years to favor native plants over ornamentals when possible for a variety of environmental reasons.

Economic Values

Have you ever thought of a tree as a stormwater conveyance system? Probably not. We commonly think of stormwater systems and other infrastructure such as highways, bridges, powerlines, and sewage treatment plants as highly engineered systems built of steel and concrete.

This infrastructure requires major capital investments to develop and ongoing funding to maintain. If we manage Seattle's urban forest well, we can maximize the infrastructure services that these trees provide for substantially less cost than the concrete and steel alternatives.

Value of Seattle's Urban Forest

The city's trees provide an economic benefit of **\$20,643,000** in stormwater retention and **\$4,894,000** in air cleaning each year.

"Green infrastructure," notably trees, also provides "ecological services" that include the ability to capture rainwater, to reduce stormwater runoff and flooding, to improve air and water quality, and to sequester global warming pollution. Many recent studies estimate a dollar value for these benefits. The extent of that economic value is directly related to the amount of tree canopy.

[add SEA Street photo in final document]

Just as we do for engineered infrastructure, it is important to consider the value of these ecological services when budgeting for green infrastructure. Seattle's innovative pilot Street Edge Alternatives project (SEA Streets) is a great example. These projects are designed to provide drainage that more closely mimics the natural landscape before development. Two years of monitoring show that SEA Street projects reduce by 98% the total volume of stormwater leaving the street during a 2-year storm event. In 1999, the City of Seattle asked American Forests, a leader in the science and practice of urban forestry, to conduct an 'Urban Ecosystem Analysis' using their CITY Green software combined with Global

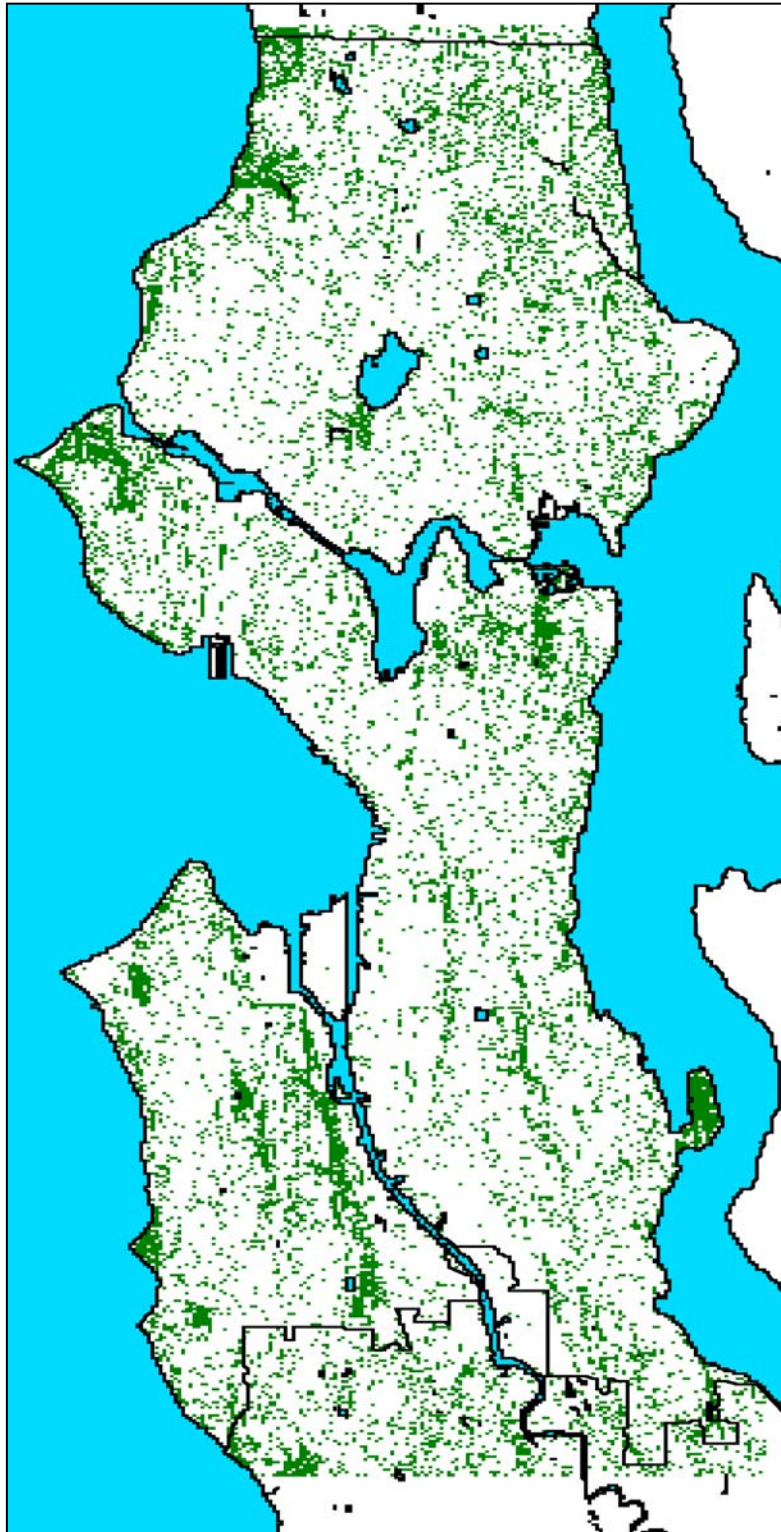
Canopy Loss is Expensive

The American Forest group's 1999 analysis concluded that between 1972 and 1996, Seattle lost 46% of its heavy tree cover and 67% of its medium tree cover.

That loss costs Seattle an estimated \$1.3 million *per year* in rainwater storage and management capacity and \$226,000 per year in air pollution-related health care costs.

Information System (GIS) technology. Based on satellite imagery from 1972 to 1996, the study found the following (Figure 1):

Figure1. Tree Canopy Cover in Seattle



- The average tree canopy coverage for Seattle is 18%, too low by national standards.
- In 1972, areas with heavy tree canopy coverage (50% or greater) comprised 10% of Seattle's 54,000 square acres, or 5,400 acres.
- By 1996, areas with heavy tree canopy coverage (50% or greater) had decreased by half, to 5% of Seattle's 54,000 acres, or about 2,800 acres.

Economic implications of canopy loss for stormwater management and clean air were clear:

- The total stormwater retention capacity of Seattle's urban forest cover was reduced by 27% from 1972 to 1996.
- This tree loss in Seattle from 1972 to 1996 resulted in an estimated 7.5 million cubic feet (cf) of additional stormwater runoff.
- The lost tree canopy would also have removed many thousands of pounds of the pollutants sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and particulate matter of 10 microns or less from the atmosphere annually. The net result is dirtier air in Seattle which also carries a cost.

Based upon the above, one would assume that restoring and enhancing Seattle's tree canopy coverage would reverse these trends and would increase the stormwater and air cleaning values of the urban forest, and such is the case. By applying cost/benefit modeling provided by the *Western Washington and Oregon Tree Guide: Benefits, Costs and Strategic Planting*, E. Greg McPherson, et al, it has been determined that an increase in Seattle's tree canopy coverage from the present 18% to 36% would more than double current environmental and economic benefits. The values are based upon the assumption all current canopy is retained and continues to grow, while new canopy will be added and will grow:

- The additional tree canopy would remove air pollutants annually, at a total value of about \$9.8 million per year.
- The stormwater retention capacity of the urban forest would also more than double at an annual value of \$41,300,000 million per year.

Many other cities have undertaken similar urban forest ecosystem analyses. A 2002 San Antonio study showed that a 20% canopy cover provides a one-time savings of \$1.35 billion in construction costs for flood control systems and sewers. The San Antonio study estimates a 25% canopy cover would avoid having to pay for an additional stormwater storage capacity of 65 million cf (valued at \$129 million). In 2003, a New York City pilot study of urban trees placed a value of \$9.5 million/year in anti-pollution benefits. The study concluded an average cumulative lifetime value of \$3,225 per tree. See [Appendix A](#) for the methodology for deriving ecological services data.

In addition to their widely recognized aesthetic worth in an urban setting, trees provide other significant economic value that can be measured. Recent studies from the University of

Washington's Center for Urban Horticulture, and other universities, have shown that trees positively affect the economic vitality of communities in the following ways:

- Higher property values
- Lower crime rates
- Higher shopping frequency
- Higher office occupancy rates
- Reduced health care costs.

Social Values

Street trees keep streets and sidewalks cool in the summer and provide scale and interest in the winter. They also calm traffic and separate pedestrians and vehicles. Seattle's system of tree-lined bike and pedestrian trails are well used and valued as a resource to promote exercise and a healthier lifestyle. Trees have been shown to improve hospital recovery times, reduce air pollution and stress on children with asthma and improve children's performance in school.

Trees are often the primary 'architectural' element in our developed parklands and, as such, define functional use areas, and add significant aesthetic character. Natural areas in City parks give urban residents access to trails and environmental learning opportunities that help keep us connected to the needs of fish and wildlife and the experience of being in nature while in the city. The presence of many trees can often define a neighborhood, and conversely, the absence of trees can do the same. As mentioned earlier, many studies show that people enjoy trees and are more comfortable in the presence of trees than they are without them in a landscape. The fact that many people plant a tree in memory of a loved one is a strong indication that we see trees as symbols of life and longevity.

1.3. An Urban Forest Sustainability Model

Unlike timber forests that are grown primarily to produce forest **products**, urban forests provide **services** such as air and water quality improvement. Urban forests are directly affected most notably by the pressures of their location in developed areas. Given this fact, management intervention is necessary to keep city trees and forest lands within cities sustainable and healthy in perpetuity. To that end, the Urban Forest Management Plan uses a planning model framework built around a basic understanding of the unique characteristics of urban forests.

Seattle's Urban Forest Management Plan is informed by "A Model of Urban Forest Sustainability." This model recognizes the challenges, benefits, and opportunities unique to city trees. It defines **sustainability for urban forests** as occurring when "naturally occurring and planted trees in cities ... are managed to provide the inhabitants with a continuing level of economic, social, environmental, and ecological benefits today and into the future."

Seattle's sustainable urban forest model is built around four principles from the model:

- Sustainability is a broad, general goal that results in the maintenance of environmental, economic and social functions and benefits over time.
- Urban forests primarily provide services rather than goods.
- Sustainable urban forests require human intervention.
- Trees growing on private lands compose the majority of urban forests.

Seattle's Urban Forest Management Plan has adapted the sustainability model to provide a structure that organizes our goals and the actions needed to achieve them. Although we've altered the main titles, we use the same three management elements as those of the model:

1. **Tree Resource:** an understanding of the trees themselves, as individuals or in forest stands
2. **Management Framework:** assignment of responsibility, resources and best practices for the care of trees
3. **Community Framework:** the way residents are engaged in planning and caring for trees. Because most trees in the urban forest are on private property, a successful program requires that the community plant and maintain trees on their property.

1.4. Goals of the Plan

Defining specific goals within each of the three elements of the plan will help guide development and prioritization of the broad range of actions necessary to achieve our vision of a sustainable forest in Seattle. Some of the overarching considerations that have heavily influenced the direction of the plan include the following:

- **Increased environmental and engineering benefits from trees.** In cities, trees and their understory perform as green infrastructure, slowing and holding stormwater, reducing erosion, buffering waterbodies from polluting runoff and cleaning the air of airborne pollutants. As the extent and health of an urban forest increases, so does its capacity to provide these green infrastructure benefits in greater amounts.
- **Improved condition of the urban forest.** An urban forest that is managed sustainably is healthier—allowing more trees to mature and more species to thrive. Healthy forests ultimately increase the ecological, social and economic benefits of the forest and improve forest management efficiency.
- **Standardized maintenance practices.** Each of the City departments with responsibility for the urban forest will share standardized maintenance practices. Standard practice increases overall consistency in how trees are maintained, resulting in better tree health and longevity.
- **Equitable urban forest resource allocation citywide.** It's important that the City and its partners allocate urban forest management resources in a manner that recognizes geographic, racial, and social equity.
- **Optimized opportunity for partnerships in urban forest preservation and enhancement.** A community—residents and businesses alike—that is provided a clear picture of the priorities, scope, timing, and resources for achieving a thriving urban forest is more likely to invest their energy and resources to help achieve that vision.
- **Policy direction or recommendations for Seattle's trees.** Issues like private views versus public trees are commonplace in Seattle. Another continuing policy discussion point is the role that trees do or do not play in the behavior of transients.
- **A document for community education and action.** City trees need to be actively cared for and managed to be healthy, safe, and coexist with homes, streets, businesses, parks, and natural areas. An urban forest management plan that is shaped by community discussion has greater ownership and will inspire more people to become informed and involved as stewards to guide future sustainable tree practices and policies.

The specific goals of this plan are shown in [Table 1](#):

Table 1. Seattle's Urban Forest Framework and Goals

Tree Resource	Management Framework	Community Framework
<p>Understand the characteristics and complexity of Seattle's urban forest</p> <p>Maintain trees to promote health and longevity</p> <p>Maximize canopy cover and optimize age and species diversity</p> <p>Maximize the ecological and environmental benefits of the urban forest</p>	<p>Facilitate interdepartmental communication and cooperation to provide decision-makers the information they need to support the UFMP</p> <p>Develop and implement resource management tools</p> <p>Preserve and protect existing trees, and encourage new tree planting throughout the city by improving management of trees on private property</p> <p>Model good stewardship in City practices</p>	<p>Enhance public awareness of the urban forest as a community resource</p> <p>Engage the community in active stewardship of the urban forest</p> <p>Promote citizen-government-business partnerships</p>

Achieving these goals will result in the following outcomes:

- Improved condition of the urban forest in terms of increased canopy, health, and diversity.
- Increased ecological service benefits such as stormwater mitigation benefits.
- Clear policy framework to guide City actions.
- Consistent approach to urban forest management and public outreach among City departments.
- Improved management and accountability within City government.
- Equitable distribution of urban forest resources across the city.
- Engaged and informed community.

2. Seattle's Urban Forest Today

Seattle's urban forest is under pressure from many sources including:

Tree Resource

- Damage from invasive plants
- Nuisance pests and diseases: tent caterpillars, aphids, fall web worm, anthracnose, other leaf spots
- Serious pests and diseases: cherry bark tortrix, armillaria, honey locust pod gall, Dutch elm disease, anthracnose.
- The introduction of pathogens that directly impact natives: madrona trees and Western red cedars
- Inadequate age and species diversity
- Trees sensitive to the compaction and root disturbance common in almost all urban areas: big-leaf maple and Western hemlock
- Constrained settings like narrow planting strips, tree pits and grates
- Impacts from traffic including air pollution, accidents, breaking low hanging limbs

Management Framework

- Limited maintenance budgets to care for City-owned trees
- Inadequate tools for monitoring and managing City-owned trees
- Insufficient incentives and regulations to preserve and encourage planting of trees on private property
- Lack of a comprehensive plan that defines critical importance of "green infrastructure" and establishes goals and sets priorities to inform management and budgets for trees.

Community Framework

- Lack of broad-based community appreciation of the benefits of professional tree management
- Lack of understanding of proper tree care requirements and practices.

- Competition for space lost to development.
- Residents' desire for views and light on their property.

The following section describes the current conditions of Seattle's urban forest after decades of such pressure.

2.1. Tree Resource

The urban forest can be evaluated using many factors, including extent of tree canopy, species diversity, age, and health of trees. As previously discussed, canopy cover in Seattle has declined to 18%. Without a more extensive canopy cover, the value of environmental and ecological services of the urban forest is greatly reduced.

Urban trees are under pressures not present in native forests and require active management intervention to sustain them. Urban trees lack some of the natural buffers and protection found in wildlands. In native forests, the combination of soil micro-organisms, understory plants, an ample seed source, number of trees, and variance in topography, and stable hydrology all contribute to impede or stop extensive destruction due to diseases, insects, and invasive plants.

Diverse tree composition reduces the risk of major losses to virulent pathogens such as chestnut blight or Dutch elm disease. While experts debate the recommended maximum percentage of a single species in the tree population to be either 5% or 10% (Barker 1975, Miller 1991), the number of genera (subdivisions) and species that thrive in Seattle allows for increased diversity to safeguard against disease.

Other pressures on trees in the urban environment are from development. These threats include land clearing to accommodate growth and views and tree removal to reduce conflicts between trees and power lines and street signs and to provide sight lines along roadways.

What is a Tree?

A tree is a single or multi-trunked plant capable of attaining a height of at least 15 feet and traditionally referred to as a 'tree' in common reference materials such as the *Sunset Western Garden Book* or similar publications.

photo

Street Trees

Seattle's estimated 130,000 street trees have a broad range of sizes. Some of our older trees were planted as part of coordinated projects in the 1920s and 1930s and others in the late 1960s and early 1970s. In the past 20 years, there have been several focused tree plantings that have created more tree-lined streets organized by the Seattle Department of Transportation (SDOT), the Department of Neighborhoods, Seattle City Light, nonprofits, neighborhood and individual residents. Seattle street trees range in size, but, overall, tend to

be much smaller when compared with other cities with longer histories of street tree planting and with wider planting strips.

Based on inventory data from 1992 and visual observations, the size distribution of street trees in residential areas has not changed much in the last 10 years. Nearly 50% of residential street trees have diameters of 5 inches or less and are relatively young. Many others are larger, with diameters of 6 to 20 inches, yet are young enough to provide benefits for many more years. With the exception of a few streets with mature plantings, private yards provide space and support the growth of many of the larger trees in residential neighborhoods.

Seattle's current tree inventory includes 105 different genera (subdivisions) and over 310 species. Diversity, however, is a problem because 67% of the street tree population is made up of just 7 genera (Table 2). Prunus (cherries, plums and laurel) are most widely planted at 24%. The maples (Acer) rank second at 18%. Together, Prunus and Acer comprise 42% of Seattle's street trees, a number that violates the general recommendation that no more than 10% of any one genus predominate the urban forest.

Table 2. Seattle Street Tree Genera Mix (2006)

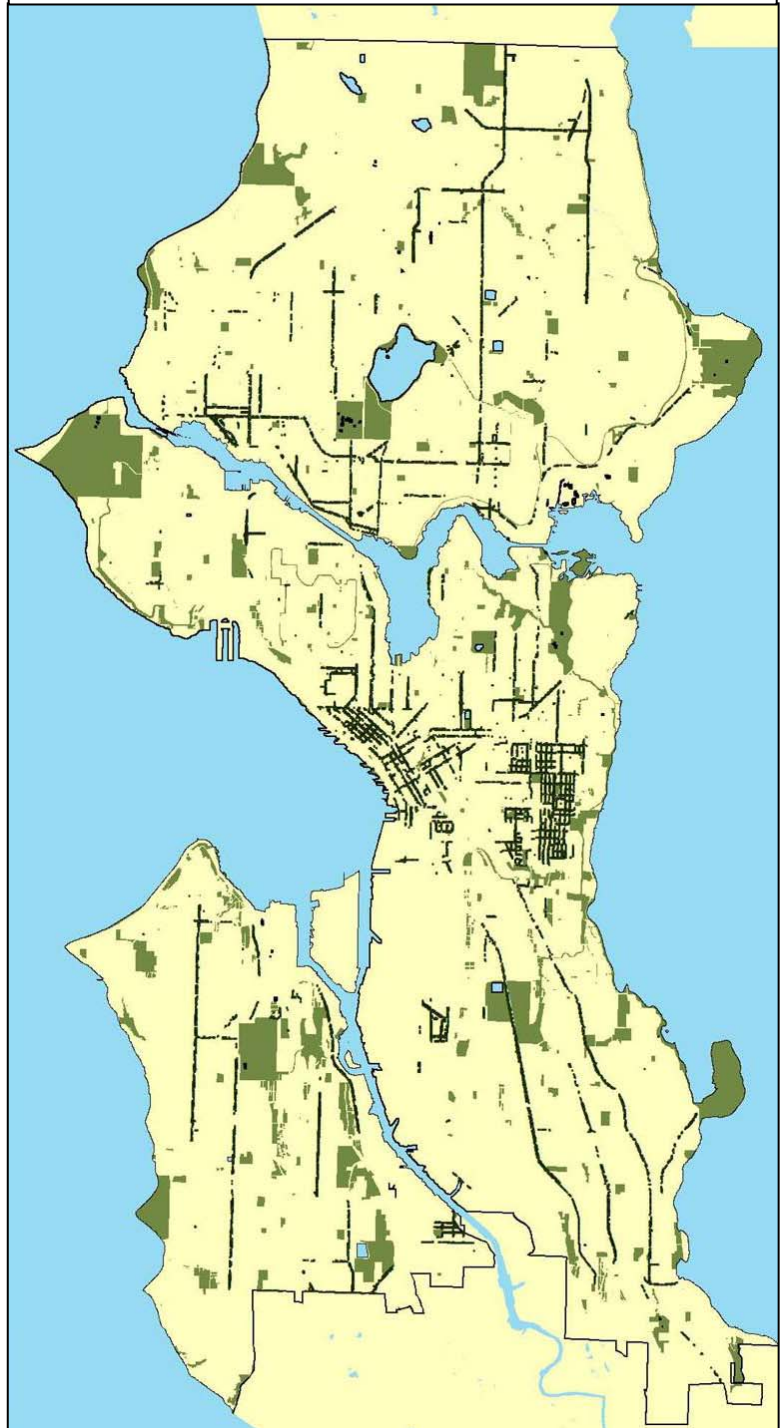
Genera	Common Name	Percent
Prunus	Cherry/Plum/Laurel	24%
Acer	Maple	18%
Crataegus	Hawthorn	7%
Malus	Apple	6%
Quercus	Oak	4%
Fraxinus	Ash	4%
Tilia	Linden	4%
Other	Pear, Sweet Gum, etc.	33%

A number of issues threaten the viability of Seattle's street trees. In the downtown core and other commercial zones, small tree pits and failure to maintain tree grates or prune surface roots can cause root/trunk girdling, shortening the tree's lifespan. Soil compaction and bike and vending machine locks also stress these trees and damage their roots and trunks. Vandalism and car crashes also cause some damage and loss. In the mid-1970s in residential areas and along arterials many trees were planted in substandard planting strips and inappropriately under powerlines. A number of these trees are now outgrowing their planting strip or tree pit. Those under wires have been repeatedly topped, which is no longer an acceptable management practice. Tree topping results in poorly attached quickly growing sprouts that require frequent pruning and weaken the tree structure. When street trees are removed, replacement may not be an option, due to incompatibility with current planting standards. Seattle's street tree locations are shown on Figure 2.

Although large trees are a rather small part of Seattle's total street tree population, people consider them highly important and resent the aesthetic impact of their loss. For example, a 40-year-old tree is perceived to be a large tree according to a study on the benefits of trees in business districts (Wolf 1998). Outreach, public notification, and education provide information about why trees are being removed, but public response can be emotional and focused on saving individual trees regardless of their condition.

SDOT requires developers to preserve healthy street trees with an extended useful life when they are compatible with projects. Redevelopment may require tree removal when preservation is not an option. With new construction, however, stressed or ill-suited trees get replaced with trees better suited to site conditions and new construction allows for introductions of new species.

Figure 2. Street Trees and Parks Owned by the City of Seattle



Parklands

Trees in Seattle's parks are found in two types of areas: developed parks or forested parklands.

Developed Parklands

The approximately 90,000 trees in Seattle's developed parks have great species diversity as well as size distribution. This distribution is a result of the staged growth of the park system. In addition, the older and larger trees of Seattle are typically found in parks across the City. Parks typically offer large areas free of the buildings and paved surfaces associated with developed properties. These parks provide trees with the space to grow and fully mature.

What's A Tree Worth?

The number of trees in Seattle's urban forest is conservatively estimated at 550,000 to 600,000 trees, with a monetary value of over **\$1 billion**.

This estimate encompasses both street and off-street trees, including trees in parks and greenbelts.

Over time, tree replacement in City parks has been uneven. Trees in high visibility park locations, such as Parks-owned boulevards, have been replaced more quickly than trees in less visible areas. In recent years, the construction of new parks has allowed additional trees to be planted. Currently, a very limited tree replacement program has regularly replaced some trees. Historically, The net effect has been to plant at least one tree for every three trees removed in developed parks.

Forested Parklands

Seattle forested parklands have too few conifers, too many deciduous trees, and too many non-native invasive plants when compared with native ecosystems. As discussed earlier, this condition is a result of clear-cutting decades ago. With no conifer seed source, the forests reseeded to alder and big-leaf maple, both relatively short-lived species. Forest restoration projects are working to combat this situation. Thousands of seedlings are planted during restoration activities each year with support from thousands of citizen volunteers.

The understory diversity depends on the structure and climate provided by the conifers of the Northwest. Additionally, the mature height of native trees (200 to 300 feet in deep forests) allows a larger volume of leaf area in a smaller footprint, vastly increasing the production of ecological benefits such as air cleaning and stormwater retention and interception.

Over time, tree replacement in City parks has been uneven. Trees in high visibility park locations, such as Parks-owned boulevards, have been replaced more quickly than trees in less visible areas. In recent years, the construction of new parks has allowed additional trees to be planted. In addition, forest restoration projects plant thousands of seedlings each year.

Private Trees

About 74% of Seattle's land base is privately owned and includes a wide spectrum of land-use types ranging from single-family to industrial and institutional. Although there is no inventory, it is apparent from looking at trees on private property, that there is a wide spectrum of tree density, age, and sizes throughout Seattle's neighborhoods. While some areas of the city enjoy proximity to nearby greenbelts, ravines, and parks, there are other neighborhoods that are defined by towering stately street trees with welcoming green archways. Some neighborhoods to the north still have scattered stands of remnant second- or third-growth conifers. Conversely, some neighborhoods have little mature canopy cover. Throughout the city, there are opportunities to plant new trees.

The greatest loss of Seattle's tree canopy has been from private property. While most Seattle residents value and enjoy trees, there are situations where trees are regarded as troublesome and either removed or topped (a very poor maintenance practice) for blocking views and sunlight or dropping leaves or fruit. While trees in business districts may be appreciated by shoppers, business owners may have concerns with their signs being visible and with maintenance. Trees in parking lots offer shade but may reduce the number of stalls. On institutional and industrial campuses trees soften buildings, absorb noise and dust, and provide outdoor space for employees and visitors to enjoy, but trees require an investment in maintenance.

Improper maintenance impairs tree health and shortens tree lifespan. Being the owner of healthy trees requires an investment in proper maintenance. Seattle has many good arborists and PlantAmnesty, a local not-for-profit, has done much to teach people how to correctly prune. They have also worked hard to foster public awareness that tree topping is bad for tree health and creates ugly and unsafe trees. Education is an ongoing process, but even for people who know how to prune, it is difficult and sometimes costly to prune mature trees that require climbing, large equipment, and specialized skills. These challenges have led to relatively poor tree maintenance practices on private property overall.

2.2. Management Framework

This section describes the current City of Seattle framework for managing the urban forest resource.

Interdepartmental Coordination

Effective interdepartmental coordination is essential for consistent delivery of urban forestry programs. A Model of Urban Forest Sustainability describes this ability as the “. . . degree to which all city departments operate with common goals and objectives.”

Urban Forest Coalition

The Urban Forest Coalition was formed in 1994 to provide a common base for coordinating development of policy, programs, and budget that need Citywide direction. It is a cooperative effort of nine City departments that have tree management responsibilities (Table 3).

By providing an opportunity for representatives to meet regularly, the coalition allows members to keep each other informed of actions that will impact the urban forest and that are either undertaken or proposed within their departments. As needed, coalition members also consider matters of urban forest management philosophy and policy and recommend action.

Interdepartmental Programs

Additionally, City departments have collaborated on several individual programs. the Green Seattle Initiative was launched on Earthday 2004 by Mayor Nickels and has three goals:

- Save Seattle’s public forests
- Make Seattle’s Neighborhoods greener
- Promote ‘green’ urban development.

Seattle’s “Clean and Green Seattle” program includes a Parks and SDOT ‘green’ element in each of the monthly litter and graffiti control projects undertaken in a selected Seattle neighborhood. On a larger scale, the Green Seattle

Many Trees — Many Missions

Trees are managed within departments to meet differing functional goals that match each department’s mission:

- **SDOT** plants and maintains 35,000 street trees and regulates planting and maintenance of 90,000 street trees. They must balance canopy cover goals with the need to minimize tree conflicts with surrounding infrastructure and transportation safety requirements.
- **City Light** prunes trees in the utility corridor to maintain electrical safety and, when necessary, replaces trees. City Light is challenged by the planting of inappropriate trees that grow into utility lines.
- **Parks** manages 90,000 trees in developed parks and over 500,000 trees in the forested areas of parks. Parks must balance a wide range of recreational goals including the desire for picnic, sports, and play areas.
- **Seattle Center** manages trees in a campus-like setting designed for neighborhood use and as a festival space where large crowds impact trees. Trees at the Center strongly influence use and character of the site. A few disease-prone species were widely planted in the 1960s. Many of these trees are reaching the end of their natural lifespan.
- **Seattle Public Utilities** As part of its stormwater, flood control, and aquatic resources protection programs, SPU manages trees along creeks in the City to maintain healthy riparian and fish habitat.
- **DPD** regulates tree preservation and planting during design and construction to protect special trees and critical areas while allowing development.
- **OSE** leads the City’s Urban Forest Coalition and manages and tracks the Mayor’s Environmental Action Agenda. Enhancing the urban forest is a top priority.

Partnership brings Parks, SPU and the Office of Sustainability and Environment together with the Cascade Land Conservancy to restore 2,500 acres of forested parkland by 2025. This 20-year project leverages extensive volunteer support to remove invasive plants and restore the forest in a staged, multi-year effort.

Table 3. City of Seattle Urban Forest Responsibilities by Department

Department	Responsibilities
Seattle Parks and Recreation (Parks)	<ul style="list-style-type: none"> • Parks manages trees distributed over 6,000 acres of developed parks, boulevards, natural areas, and other publicly-owned open spaces. • The 2004 budget for all forestry related programs within Parks was \$1,460,157 to \$563,948 in general fund support, \$301,209 from the Pro Parks Levy and \$595,000 from the City's CRF • The staff consists of a Senior Urban Forester, a Forestry Crew Chief and three 3-person tree crews. Staff is responsible for tree maintenance and response to citizens and City staff on tree-related issues: view pruning, hazard trees, and damaged trees and sidewalks. • An urban forester heads the Forest Restoration Program (CRF-funded). Begun in 1994, the program is designed to plan for the restoration and long-term health and integrity of forested parklands. • A 3-person Pro Parks Levy-funded Natural Area Crew is focused on forest restoration and trail maintenance work. • Parks Trails Restoration Program is the Forestry Unit's CRF-funded program. It's focused on the rebuilding and restoration of existing park trail systems. Two full-time positions are assigned to this program.
Contact	Horticulture & Forestry Manager, 206-684-4108 Senior Urban Forester, 206-684-4113 Parks tree maintenance: http://www.ci.seattle.wa.us/parks/Horticulture/treemaintenance.htm Forest restoration: http://www.ci.seattle.wa.us/parks/Horticulture/forestrestoration.htm
Seattle Department of Transportation (SDOT)	<ul style="list-style-type: none"> • SDOT Urban Forestry is responsible for design, installation, and stewardship of trees and landscapes associated with public ROW. • Seattle has over 130,000 street trees. SDOT is responsible for maintaining 35,000 of these. The remaining 90,000 are the responsibility of adjacent property owners. SDOT-owned street trees have an estimated, conservative value of over \$100 million. • SDOT dedicates \$450,000 to tree operations and maintenance each year which includes a 3-person tree crew and supervisor. • The City arborist regulates planting, pruning, and removal of street trees through SDOT's permitting process. • An arboriculturist coordinates volunteers who maintain traffic circles and other streetside plantings throughout Seattle.
Contact	Urban Forest Manager, 206-233-7829 City Arborist 206-615-0957 http://www.cityofseattle.net/transportation/forestry.htm

Table 3 (cont.). City of Seattle Urban Forest Responsibilities by Department

Department	Responsibilities
Seattle Center	<ul style="list-style-type: none"> Seattle Center is a unique 74-acre campus. It hosts hundreds of community events and three major festivals each year. There is constant pressure on the trees and landscape from resident organizations, promoters, and citizens. Seattle Center landscape staff must diligently protect trees from a wide variety of potential abuses. Landscape staff is responsible for health and maintenance of about 750 trees (excluding street trees). This work includes protecting trees during construction (a frequent site condition over the past several years) and identifying and removing hazard trees. As in any widely used civic space, there is pressure to remove trees to increase visibility for signage, clearances, art work, and public safety.
Contact	Landscape Supervisor, 206-615-0364
Seattle City Light (City Light)	<ul style="list-style-type: none"> City Light's primary urban forest responsibility is tree pruning and trimming for electric line clearance. By law, only electrically qualified journeymen tree trimmers who are certified annually to do line clearance work are allowed to prune trees within a 10-foot radius of energized electric wires. Electrical lineworkers may trim trees in an emergency. Pruning is contracted out. In 2005, 8 contract crews performed work for all City Light territory compared with 15 or 16 crews in the late 1990s. Other City Light responsibilities include emergency tree removal when a line is down, an urban tree replacement program, notification of the public before routine pruning, and substation landscaping maintenance.
Contact	Arboriculturist, 206-386-1902
Seattle Public Utilities (SPU)	Urban forest health has recently become an area of interest for SPU, primarily as a component of the Urban Creeks Legacy Program. This program focuses on the relationship between a healthy urban forest and a natural drainage system of streams, lakes, and Puget Sound capable of supporting protected fisheries populations. Increasingly, SPU partners with SDOT and Parks to enhance neighborhoods and parks in rebuilding habitat for fish. SPU's roles in the urban forest also extends to its Natural Landscaping Program (aimed at the public) and its construction practices/specifications associated with installing water and sewer lines under ROW planting strips.
Contact	206-733-9157
Office of Sustainability and Environment (OSE)	<p>OSE is a member of the Urban Forest Coalition and specifically tasked with helping to do the following:</p> <ul style="list-style-type: none"> Provide interdepartmental coordination Support policy/program consistency with the Mayor's Environmental Action Agenda Achieve broader awareness in City government of the economic, social and environmental value of a healthy urban forest. <p>OSE led development of the Urban Forest Strategic Plan, chaired the UFC for several years, and provides a leadership role in the Green Seattle Partnership.</p>
Contact	206-386-4595 http://www.seattle.gov/environment/

Table 3 (cont.). City of Seattle Urban Forest Responsibilities by Department

Department	Responsibilities
Department of Neighborhoods	Since 1996, the Neighborhood Matching Fund's Tree Fund program has provided over 17,200 trees to over 600 neighborhood groups for Seattle's streets and parks. Groups of five or more households on residential streets with planting strips and sidewalks can apply for 10 to 40 trees. Neighbors are responsible for planting and maintaining their trees. Current funding remains stable at about \$50,000 per year.
Contact	206-684 0320
Department of Planning and Development (DPD)	<p>DPD enforces regulations relating to trees on private properties. Relevant regulations and plans include the following:</p> <ul style="list-style-type: none"> • City of Seattle <i>Comprehensive Plan</i> includes goals and policies for trees on private property and City-owned land. • <i>Environmentally Critical Areas Ordinances</i> regulates vegetation and tree removal within wetlands, wetland buffers, riparian corridors, landslide prone areas and wildlife habitat areas (ordinances 116253 and 116976). • <i>Land Use Code</i> includes provisions that provide an option for preserving trees in single- and multi-family zoned properties undergoing development (ordinance 119792). • Chapter 25.11 of the Land Use Code (<i>Tree Protection Ordinance</i>, #120410) generally protects trees greater than 6 inches in diameter on undeveloped land and it protects exceptional trees on private properties during development whenever practical. • Director's Rule 13-92 addresses landscape standards.
Contact	206-684-0432
Fleets and Facilities	The Fleets and Facilities Department manages properties and facilities owned or leased by the City. This includes vacant property, as well as buildings serving the Seattle Fire Department, Seattle Police Department, downtown office buildings, campuses housing construction and heavy maintenance vehicles and various buildings throughout the community. Their goal is to preserve as many trees as possible on all sites, and to create landscaped areas around buildings/properties.

Maintenance

Urban trees typically require maintenance. The goals of maintenance are to promote health, provide safe and functioning public spaces, and maximize the environmental, social, and economic benefits of trees and understory.

Tree maintenance tasks and frequency vary depending on age, species, establishment, and site characteristics. Generally, the first 3 years of a tree's life, also known as the plant establishment period, are the most maintenance-intensive. Establishment requires attention to tree selection, site preparation, planting, watering, staking, pruning, and mulching to assure their survival. Pruning, disease and insect management are critical throughout a tree's life.

Street trees may require additional watering beyond the plant establishment period because of the impervious paved surfaces, which also radiate heat that increases evaporation. Street trees also require care to protect the tree as it grows in a confined setting. Such care could be removing tight pavers, lawn edging, weed barrier, or tree grates and even making larger tree pits. If not removed, these materials can girdle and kill a tree by cutting off the flow of nutrients and water between the leaves and the roots.

What is Tree Maintenance?

Tree Maintenance includes everything from establishment to removal to achieve the following goals:

- promote health
- provide safe and functioning public spaces
- maximize the environmental, social, and economic benefits of trees and their understory

Tree maintenance tasks and frequency vary depending on age, species, establishment, and site characteristics.

Establishment of all aged trees requires attention to tree selection, site preparation, planting, watering, staking, pruning and mulching.

Pruning is a specialized type of maintenance. Pruning can be done reactively to eliminate hazards such as clearing obstructed signs or removing branches at risk of falling or preventively for tree health and safety. Proactive pruning for health and safety is pruning to remove diseased or insect-infested wood, improve air flow to reduce disease and insects, remove crossing or rubbing branches, develop a strong structure, remove broken limbs to encourage wound closure and prevent hazards, and prevent obstructions with signs and pedestrian traffic. The City's best management practices (BMPs) are guided by the ANSI 300 Industry standards that define how to prune trees for health, structural integrity, and clearance.

An important benchmark for urban forestry program performance is how often trees are pruned. The City of Milwaukee, Wisconsin, for example, employs one tree trimmer for every 840 street trees, or one 3-person tree crew for every 2,500 trees. As a result, Milwaukee's tree maintenance cycle is well within the industry standard of managing pruning of all trees on a 5- to 7-year cycle. (Miller 1988). The advantage of shorter pruning cycles is longer lived, healthier trees that are able to provide maximum environmental, economic, and social benefits over time. In contrast, Seattle has on average one tree employee for every 12,000 street trees with a resulting 18-year pruning cycle. This cycle means that trees are receiving little or no real preventive maintenance and many will need to be removed much earlier than should be

expected. It also means that when the trees are pruned, much more work is required than would be expected with a shorter pruning cycle. In other words, part of the reason that Milwaukee's tree crews can prune 2,500 trees per year is because their shorter pruning cycle requires less work per tree when pruned.

As mentioned earlier, Parks is responsible for 90,000 trees in developed park properties and along park-owned boulevards. Until the late 1980s, Parks had only one 3-person tree crew for all park tree maintenance. With a pruning cycle at the time that exceeded 50 years, over 90% of Parks available tree crew time was spent responding to demand-based tree-related emergencies, primarily the removal of dead, diseased or fallen trees. A second 3-person crew was added in 1988, which reduced the apparent pruning cycle to 26 years, but the percentage of time spent on demand maintenance did not change. The second tree crew was actually reduced by two positions in a 1990 budget reduction and then fully restored in 1992.

The 2000 Pro Parks Levy added a third 3-person tree crew to Parks that was dedicated to providing preventive tree maintenance in high-use park locations. As a result, Park's tree pruning cycle went from 26 years to 18 years. After operating for over 100 years with only one tree crew and pruning cycles of 26+ years, Parks is still catching up with the natural process of tree growth and death. In 2000, Parks funded a 'hazard tree mitigation program' that now allocates over \$80,000 per year in contracted hazard tree removal and replacement.

Maintenance of Private Trees

While the City does have some influence on preserving trees on private property (Appendix B: Tree Regulations and Policy), ensuring that private citizens know what appropriate tree maintenance is can be a challenge as evidenced by the all too frequent topping practice still employed by some tree maintenance firms. Encouraging private citizens to preserve trees can also be a challenge given concerns with leaf drop, views, solar access, competing uses of space, and the cost of hiring professional tree care workers. Likewise, encouraging private homeowners to plant more trees can be a challenge for the same reasons.

Still, many Seattle residents as individuals or as neighborhood groups are eager to plant trees. The City's Department of Neighborhood's tree fund and City Light's Urban Tree Replacement Program offer free street trees to neighborhood groups and provide information on proper tree planting and care. These publicly-funded programs, however, do not meet the need to provide incentives or assistance for tree planting on private property. In the past, the City successfully partnered with private businesses to sponsor discount tree coupons, which were popular and gave residents flexibility as to where trees were planted. However, still more can be done to educate and inform the public about the value of trees that will lead to more tree preservation and planting.

Standards of Practice

The standards of practice followed by City staff and their contractors are the industry standards as defined in the International Society of Arboriculture's (ISA) Tree Pruning Guidelines and/or those in the American National Standards Institute (ANSI) A300 pruning standards and the Z133.1 Safety standards. Many of Seattle's urban forestry managers and

tree-crew personnel have been trained, tested and become ISA 'Certified Arborists'. An increasing number of arborists in the region's tree service firms are also ISA certified.

To encourage the public to plant "the right tree in the right place," to avoid interference with power lines and impacts on sidewalks and underground infrastructure, both SDOT and City Light distribute attractively-illustrated booklets. This public information gives the characteristics and requirements for a number of tree species.

In 1999 Parks produced a BMP manual for their landscape, horticulture, and forestry operations. Updated in 2004, the manual provides staff with significant information on the best practices for tree maintenance and forested parklands restoration. Most of Parks' staff has also been trained in the field application of these BMPs.

Tools for Inventory and Assessment

A common requirement for all resource managers is a thorough understanding of the resource itself. To that end, Seattle needs better assessment tools to evaluate the condition, values, benefits, needs and opportunities associated with its urban forest. A more complete picture will help the City better plan and manage all tree-related work. The following are three critical needs:

1. More complete and current tree inventory
2. Better maintenance records with records linked to inventory data
3. Better tools/models for determining the value and benefits of the urban forest.

As stated earlier, having a good understanding of the resource and its condition is always the first requirement of good resource management. In addition, detailed information on resources expended for maintenance would help staff better plan and budget work. The ability to assign value to the benefits of the forest would aid in creating a business case for valuing green infrastructure in the same way the City considers the capital investment and maintenance needs of its engineered infrastructure. In turn, this could lead to creative mechanisms for funding appropriate levels of maintenance of the urban forest resource.

Developed Areas Tree Inventory

A current inventory of tree locations, species, age, health, and size is critical for planning tree replacement, pruning, disease management, and planting. Seattle's street tree inventory, although now linked into the City's GIS, is neither complete nor adequate. The street tree inventory was not designed to be readily updated. Most of its information was collected between 1989 and 1992, making work records and costs difficult to track. Likewise, it's difficult to summarize tree age, size, condition, and canopy as a basis for estimating upcoming workloads, costs, and benefits.

Based on a 1986 update of Parks' grounds maintenance management system, the City has an approximate count of trees in developed parks and along park-owned boulevards. Another

inventory was undertaken in 1997 but has subsequently been determined to be incomplete. Parks does not have information by species, size, and specific location. Although trees in landscaped portions of parks require maintenance comparable to that for street trees, they are not currently part of an integrated inventory or work management system.

Acquiring reasonably accurate information for Seattle's estimated 130,000 street trees and 90,000 trees in developed park areas will require adequate staffing and budget. Once this inventory information is in place, maintaining the inventory need not be costly given the City's GPS and GIS technology.

Forested Parklands Tree Inventory

Seattle's 3,200 acres of remnant forests have been inventoried in recent years using two different methods. The nonprofit, Seattle Urban Nature Project (SUNP) has undertaken a thorough ecosystem-based analysis of all the City's remnant forests. The City was involved with this project in an advisory capacity and has full access to the information collected. In 2004 Parks staff used Lidar (aerial laser radar) to determine citywide canopy cover percentages. Together, these two sets of data provide an excellent inventory of our remnant forests.

Maintenance Record Keeping

Seattle's lack of detailed maintenance records makes workload planning difficult and contrasts with cities known for effective urban forestry programs. Many cities maintain records of per-unit costs and person-hours required for tree establishment, pruning, inspection, removal, and other procedures. Many tracking systems identify such components as time in travel, work set-up, production and crew productivity. Having such information available also assists greatly in answering questions from the public regarding how and where tree maintenance resources are being used. SDOT currently uses a system that provides basic cost information about tree care operations but is not integrated with any other system or inventory data. City departments are developing the ability to better track maintenance activities. New systems are anticipated to be operational in 2008.

Performance Measures

Though departments track program information such as the number of trees planted or removed, there is currently no citywide system for comprehensively evaluating the condition of the urban forest and tracking our progress in implementing actions that are the goals of this plan. Because the City lacks a performance monitoring system, it cannot as effectively make program and budget decisions, adapt to changing conditions over time, or effectively communicate with senior management and the public.

Some suggested performance measures that evaluate the social, economic, and environmental progress are:

Public involvement as urban forestry stewards.

- Calls for assistance and information
- Site inspections

- Average response time
- Customer satisfaction, rated by new program participants
- Presentations and educational events
- Volunteers trained
- Volunteers participating
- Youth participating

Effective management of public trees.

- Changes in species diversity
- Number of work requests completed
- Changes in canopy cover
- Technical review of projects completed on time
- Changes in survival of new trees

Urban Forestry as a good public investment.

- Value of grants, donations, sponsorships
- Estimated value (in millions) of benefits provided by newly planted trees over a 30- and 50- year period.
- Value of programs per unit tree cost (planted and maintained for 5 years).

Tree Policies/Regulations

City planning has a number of documents, policies, programs, and regulations that establish a framework for tree preservation, planting and care. This wide range of guiding and regulatory documents reflects the complexity of tree management issues in urban settings. This complexity leads to challenges in creating policy alignment across departments as trees are necessarily considered differently based on differing department missions. For example, pruning to maintain utility line clearances for electrical safety is very different from pruning to enhance air flow to prevent disease on a park tree.

Further, current regulations are not adequate to enhance or adequately ensure tree preservation and planting on private property. Density goals and development pressures must be balanced with tree protection and planting goals. Regulations, policies and programs designed to protect and increase Seattle's urban forest are listed in **Appendix B, Tree Policies and Regulations**.

2.3. Community Framework

A sustainable urban forest is a community asset. Community appreciation for the benefits and needs of trees and engagement in planning, planting and caring for trees is essential to the long-term health of the asset. Citizen input and volunteer participation are critical to the success of City programs that support trees and have been since the days of the Olmsted plan. Without the active support and engagement of the community, urban forestry programs cannot succeed. This section describes the ways the community is currently informed about and participates in stewardship of the urban forest.

Outreach

The City has an important role in fostering residents' understanding of the environmental, economic, and community benefits of trees as well as proper tree selection, planting and care. City departments provide information through the City's website, brochures and other publications, environmental learning center activities, and during volunteer events. The book and companion video, *A City Among the Trees*, produced by the Urban Forest Coalition, with a grant from the USDA Forest Service, was designed to provide the public with information on proper tree planting and care and is available at libraries. This document has been shared with literally thousands of Seattle residents.

Different departments within the City communicate with the public about tree-related issues pertinent to their specific missions. For example, DPD provides information on tree planting and preservation requirements during development. SDOT provides information about tree selection, care and related permit requirements regarding planting trees in the street ROW. Parks provides broad information about tree care, benefits and the threat that invasive species pose to trees. Training is also a requirement for receiving Neighborhood Tree Fund grants for planting trees in the ROW. Despite this good work, the amount of coordination between different departments on outreach activities is sometimes limited, and it can be difficult for a resident to know exactly who in the City to contact with questions.

Volunteer Opportunities

Seattle citizens volunteer many thousands of hours of support for the City's urban forestry programs each year. The Parks department's three volunteer coordinators facilitate 110,000 hours of outdoor volunteer stewardship each year in City parks. In 2000, engaged citizen volunteers contributed over 50,000 hours of community service to forest restoration efforts alone. By 2005 that number increased to over 70,000 hours as a result of the work of the Green Seattle Partnership. Neighborhood and civic groups are the major source of citizen involvement in tree planting and stewardship. Volunteers plant trees and maintain park vegetation in developed and forested parklands. In many cases, specific individuals stand out

as active volunteers and receive training in organizing and directing tree planting and maintenance projects.

The former SDOT Tree Steward program was a nationally recognized leader in citizen forester training. It demonstrated the benefit of training “citizen foresters” who learned basic tree maintenance and neighborhood organization skills. Since the program’s elimination, SDOT has adapted to limited staffing and budget by taking a broader approach to supporting volunteers and providing public information. For example, SDOT recruits and trains volunteers to maintain over 1,000 traffic circles and other street-side landscaped areas. SDOT also works with the Department of Neighborhoods to train residents in proper planting and maintenance in their Neighborhood Tree Program.

Through its Neighborhood Tree Fund, the Department of Neighborhoods has empowered residents to plant almost 17,700 street and park trees as part of neighborhood greening projects since 1996. Recipients praise and support the program, but are concerned that the program provides limited maintenance funds or materials for the post-planting period.

Planning and Policy Development

Seattle residents have opportunities to participate in urban forest planning and policy development through public comment during major plan development, participation in oversight and planning committees and through the Board of Parks Commissioners. Neighborhoods have become the basic unit of Seattle’s ongoing comprehensive planning. Virtually all Seattle neighborhood plans, adopted by the City Council, mentioned tree planting and stewardship among their priorities.

The 2000 Pro Parks Levy and similar initiatives incorporate citizen planning and participation on oversight committees. Parks also has developed a “Public Involvement Policy” that establishes parameters for when a project or policy change will include public input, this includes seeking public input on tree planting and maintenance programs as well as notifications of all tree removals. The Seattle’s Board of Park Commissioners also provides advice on policy matters in Seattle parks and takes public comment into consideration.

Seattle does not have a citizen’s advisory board dedicated to urban forest issues. Some cities have tree boards or commissions that are comprised of representatives from various interest groups, green industry, educational institutions and the business community. In Washington State, the cities of Woodinville, Poulsbo, Enumclaw, Burien, Longview and Tumwater all have tree boards.

In the past, such an advisory board was convened to engage the community on specific issues. In 1969, Mayor Wes Uhlman initiated Seattle’s Street Tree Advisory Committee to help prioritize Forward Thrust Bond tree plantings. The committee was reconvened in 1972 to review SDOT street tree planting projects and work on a Street Tree Ordinance and long-range

master plan. Jerry Clark, City Arborist from 1988-1997, revived the Street Tree Advisory Board for a brief period to help build private support for street tree planting.

Partnerships

Early in Seattle's history, a few people of vision rallied an entire city behind funding and building the foundation of Seattle's parks and boulevard system with an Olmsted designed plan. In preparation for hosting the World's Fair in 1962, The Weyerhaeuser Company donated 1,000 street trees that were subsequently planted. It was another partnership of insightful civic leaders motivated by the Women's Division of the Seattle Chamber of Commerce and supported by voters who envisioned and passed the Forward Thrust Bond in 1968. Forward Thrust funded the construction of over 50 planted triangles and thousands of street trees.

In more recent times, in addition to working with neighborhood volunteers on tree programs, the City continues to partner with individual businesses, chambers of commerce, nonprofits, the media, neighborhood councils, business improvement districts, and state and federal agencies. These partnerships illustrate that urban forestry is about community as much as it is about trees.

One partnership of note is the 1999/2000 Millennium Woods Legacy Project which, in celebration of the new millennium, surpassed the goal of planting 20,000 trees in city parks, yards and streets. Sponsors included ATT, GTE Wireless, Eddie Bauer, TREEmendous Seattle, and PlantAmnesty.

The Green Seattle Partnership was formed in 2004 by a Memorandum of Agreement between the City of Seattle and the Cascade Land Conservancy. The partnership a 20-year program to restore 2,500 acres of forested parklands by 2025. To get there, the partnership plans to restore an increasing amount of forested parkland each year reaching 150 to 160 acres per year at program peak in 2010. In addition to removing invasive plants and re-establishing forest tree canopy and understory, valuable in its own right, the partnership will restore the ecological services of Seattle's remnant forests. Volunteers are the key to the success of the program. At its peak of restoration work, the Green Seattle Partnership will require over 100,000 hours of volunteer support annually from youth, community and business groups. With over 15 years of experience in building neighborhood-based volunteer support, Parks has proof that Seattle citizens are up to this task.

These initiatives would not have happened without individuals and organizations contributing their talents, energy, and dollars to ensure that there is a green Seattle legacy established for future generations.

Regional Cooperation

Regional cooperation involves promoting interaction among neighboring communities, regional groups, agencies and neighborhood groups. The City has participated in the Puget Sound Urban Resources Partnership (PSURP), which brings together federal, state, county and city governments and private institutions and businesses to collaborate on urban ecology projects. As an example, there is ongoing City involvement with the Mountains to Sound Greenway Trust, a coalition dedicated to preserving visual resources and to restoring and connecting forested land along I-90.

3. Recommended Goals and Actions

This section identifies goals and specific actions needed to enhance and preserve Seattle's trees. Establishing the City's goals for canopy cover overall and by management unit is a necessary first step and will help guide the identification and prioritization of actions.

3.1. Why Does the City Need Canopy Cover Goals?

A good measure of the health and value of an urban forest is the percentage of land within the city that has tree canopy cover. In order to measure success in canopy cover enhancement, canopy cover goals must first be established. These goals will help the city to rally the community around a clear set of common targets. They also help to plan implementation steps that consider planting opportunity, planting limitations and other priorities specific to individual land-use types. With canopy cover goals, we can target limited budget to areas with the greatest potential for new trees or the greatest lack of trees. Finally, having canopy cover goals allows us to target new tree plantings to maximize the ecological services potential (e.g. stormwater mitigation, carbon sequestration) across the city. Within this context, 30-year citywide canopy cover goals has been established to increase existing canopy cover by 2/3 to 30%.

3.2. How Did We Derive Canopy Cover Goals?

American Forests, leaders in urban forest management and research, measured tree cover in 440 communities. They recommended that a canopy cover goal of 40% would be appropriate for Seattle and other cities in the Pacific Northwest region. In developing canopy cover goals for Seattle, the Urban Forest Coalition started with the American Forests recommendation and went through the following process to define an ambitious but doable goal for the Urban Forest Management Plan 30-year planning horizon (Table 4):

- Considered American Forests' recommendations and benchmarked with other cities
- Considered land-use mix in Seattle and other City land-use goals (e.g. encouraging density, facilitating freight mobility, etc.)
- Considered current canopy cover and planting opportunities
- Defined goals for each land-use type

- Factored in the percentage of the total land base within each land-use type and individual land-use goals to calculate the recommended citywide goal of 36%
- Consulted with external experts from other cities, consultants, the University of Washington and the public.

Table 4. Canopy Cover Goals by Management Unit (MU)*

Land Use Category	Current Canopy Cover	Current Trees	30-year Canopy Cover Goal	Est. New Trees to Meet Goal
Single-Family	17.8%	473,300	31%	350,200
Multi-Family	13%	103,400	20%	56,000
Commercial/Mixed Use	8%	49,700	15%	44,400
Downtown	8.6%	9,700	12%	3,800
Manufacturing/Industrial	8%	68,100	10%	18,100
Institutional Properties	15%	14,600	20%	5,000
Parks: developed sites	19%	90,000	25%	28,400
Parks: natural areas	64%	568,700	80%	143,200
Citywide	18%	1,377,500	30%	649,100
Transportation Corridors/Street ROW	16%		24%	

*Seattle's street trees are included in the land-use types that contain streets and street tree plantings. Current street tree canopy cover is 16% with a canopy cover goal of 24%.

3.3. What Canopy Cover Goals Have Other Cities Adopted?

The American Forests model was the starting point for setting goals in these other cities:

- Vancouver, WA has current canopy cover of 19.7% and has established a citywide goal of 28%.
- Portland, OR has current canopy cover of 26.3% and has established a goal for residential areas of 47% and for industrial/commercial areas of 12%.
- Baltimore, MD has a current canopy cover of 19.8% and set a goal to double (39.6%) canopy cover citywide within 30 years.

Urban Forest Inventory and Estimates

The forest canopy of a city can be measured in a variety of methods. For this plan, Seattle's canopy was measured using LIDAR. LIDAR measures the height and location of objects based on reflection of a laser. The data collected is high definition—five measurements for each 1 meter square. The elevations, which are within 2 feet of actual heights, were used to create a topographic map of the city.

A by-product of this data is a highly accurate, 3-dimensional map of Seattle's tree canopy. Existing GIS data for the Management Units (MUs) was used to develop values for canopy cover in each MU.

3.4. Recommended Actions

(Table 5) shows the general goals of the plan, the rationale for the goals and associated recommended actions. The goals and actions have been grouped into the three elements of the urban forest sustainability model: Urban Forest (Tree) Resource, Management Framework and Community Framework.

Each goal statement is followed by the supporting rationale for the goal, which is then followed by short, mid- and long-term recommendations/actions to achieve the goals. Implementation will require policy, program, and budget coordination, as well as long-term and stable funding. Accomplishing these goals is essential for the City to achieve urban forest sustainability. These actions generally apply to trees throughout the city as opposed to those trees found within a specific forest Management Unit (MU) as described in the next section. The timeline definitions for implementing the proposed actions are as follows:

- Short-term actions will be done within the next 5 years. Typically these are actions that are either already partially implemented, 'budget neutral,' or have agreed upon new funding in place.
- Mid-term actions are 5 to 10 years out. These are actions that might require operational restructuring or reorganization, limited additional funding, or 'tooling-up' on the part of internal or external partners.
- Long-term actions are 10 or more years on the horizon. These actions may have significant budget implications, may involve organizational change, and might require significant fund raising.

Table 5. Goals and Recommended Actions for the Seattle Urban Forest Management Plan

Tree Resource				
Goals	Rationale	Short-term	Mid-term	Long-term
A1. Understand the characteristics and complexity of Seattle's urban forest	<p>A fundamental requirement for effective resource management is a thorough understanding of the resource itself. This is accomplished through inventory and analysis and is essential for implementation of all resource management tools from cost/benefit analysis to workload management. An inventory of the urban forest needs to be comprehensive, dynamic and available to forest managers within all applicable departments.</p>	<ul style="list-style-type: none"> • Coordinate inventory data from SUNP with City needs for inventory and assessment of natural areas. • Develop long-term tree management strategies that consider the unique characteristics of the major city land-use types • Develop modeling for tree ages and sizes and life expectancy, accounting for species and site factors, to facilitate costs projections. 	<ul style="list-style-type: none"> • Develop vegetation data analyses, models and reports for input to policy, planning, and budget decisions. • Inventory street trees and of trees in developed parks and along park-owned boulevards. • Identify and catalogue landmark and heritage trees throughout City, building on the existing program. 	<ul style="list-style-type: none"> • Examine canopy-cover effects on views, solar access and property values across different land-use types. • Develop a dynamic inventory process that can be updated and maintained.
A2. Maintain trees to promote health and longevity	<p>Healthy trees contribute more to Seattle's environment and quality of life than do unhealthy trees. Trees maintained on a regular cycle are healthier, live longer and reduce the City's liability from hazards such as dead limbs.</p> <p>City maintenance practices should be consistent with the most current industry standards.</p>	<ul style="list-style-type: none"> • Maintain trees on a regular, more frequent, cycle for health and longevity • Maintain trees based upon commonly accepted ANSI or International Society of Arboriculture (ISA) practices/BMPs. • Determine the desired tree maintenance cycle for all urban forest management units. • Request additional tree maintenance resources in the 2007/2008 budget process. 	<ul style="list-style-type: none"> • Develop an urban forest maintenance plan for all city-owned trees. • Consider alternative models for street tree management. • Continue to make budget requests to increase tree maintenance capacity and to reduce annual pruning cycles. 	<ul style="list-style-type: none"> • Use more understory species, where appropriate, for increased and multi-layered canopy. • Continue to make budget requests to increase tree maintenance capacity and to reduce annual pruning cycles • Seek and acquire tree maintenance resources required to maintain

		<ul style="list-style-type: none"> • Use current and future modeling to determine the <u>resources required</u> to adequately preserve, restore and enhance the urban forest. 		Seattle's public trees at industry standards.
A3. Maximize canopy cover and optimize age and species diversity	<p>The many benefits provided by trees increase as the tree population and overall canopy coverage increase. Significant species diversity helps ensure no single pathogen or insect can decimate an entire population. A range of tree ages helps ensure continuity and sustainability of the forest.</p>	<ul style="list-style-type: none"> • Continue planting “the right tree in the right place” to ensure healthy, stable and sustainable trees. • Define appropriate age/size/species distribution and life expectancy goals for different areas and land uses (greenbelts, parks, commercial and industrial areas, transportation corridors, etc.). 	<ul style="list-style-type: none"> • Plant large trees where they have room to mature and plan shorter rotations of small- and medium-sized trees in areas with limited growing area. Develop tree selection lists for the same. • Fund and coordinate City programs to provide trees to the public and support stewardship. 	<ul style="list-style-type: none"> • Achieve tree canopy cover percentage goals by land-use type
A4. Maximize the ecological and environmental benefits of the urban forest	<p>Trees provide ecological services including stormwater mitigation and air and water quality improvement. Maximizing these services saves money and improves quality of life but also requires an investment of resources. Effectively measuring (using financial values whenever possible) and communicating these benefits is necessary to inform decisions about resource allocation so that decision-makers and the community can fully understand the benefits that tree management investments return.</p>	<ul style="list-style-type: none"> • Define the economic and environmental benefits derived from the ecological services provided by a healthy urban forest in Seattle (at current and proposed canopy coverage % levels). • Continue funding of Parks Forest Restoration Program. • As part of implementing all urban forest projects and programs, consider potential environmental enhancements. • Think “citywide” when implementing projects to capitalize on potential synergies for environmental enhancements between 	<ul style="list-style-type: none"> • Consider environmental functions in BMPs. • Consider streams, trails and other forest amenities when developing forest restoration projects. • Seek sufficient funding in budget process to meet operation and maintenance objectives. • Ensure an adequate budget to finance the highest priority activities identified in the management plan. • Explore funding opportunities with the business community and with regional donors, 	<ul style="list-style-type: none"> • Look at the forest as a population, balancing concern for individual trees with the values and functions of the entire system. • Encourage planting designs having grouped rather than evenly spaced trees that better contribute to wildlife habitat. • Explore creative financing mechanisms to obtain funding for city urban forestry

		<p>departments.</p> <ul style="list-style-type: none">• Consider ecological services <u>values</u> as the basis for creative funding considerations for urban forest restoration and maintenance.	<p>particularly for special projects identified in a management plan.</p> <ul style="list-style-type: none">• Examine canopy-cover effects on views, solar access and property values across different land-use types.	<p>programs.</p>
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Table 5. Goals and Recommended Actions for the Seattle Urban Forest Management Plan (Cont.)

Management Framework				
Goals	Rationale	Short-term	Mid-term	Long-term
B1. Facilitate interdepartmental communication and cooperation to provide decision-makers the information they need to support the UFMP	<p>Urban forestry in the City of Seattle involves many departments and links to outside agencies. Jurisdictional boundaries can sometimes be difficult to determine. Multiple departments each with its own primary mission also manage trees. It's vital that City departments have effective processes in place to communicate with one another regarding common urban forestry issues ranging from budget development and maintenance practices to related programs such as salmon recovery efforts.</p>	<ul style="list-style-type: none"> • Continue Urban Forest coalition (UFC) as the group primarily responsible for implementing the UFMP through the work of the represented departments. • Report to the Growth Management Sub-Cabinet quarterly as the executive level advisory body for the UFC. • Link urban forest management to other City programs, especially environmental programs. (e.g., SPU and Parks programs) • Integrate urban forest management planning with other City efforts affecting vegetation, open spaces and sustainable development • Coordinate all City policies and regulations related to trees. • Begin long-term development of funding 	<ul style="list-style-type: none"> • Create inter-departmental working groups to coordinate interests, expertise and resources for particular issues areas (e.g., volunteer support, public education, stormwater management, salmon recovery, etc.). • Track cost-effectiveness of current organizational structure and management practices. • UFC will be responsible for recommending UFMP implementation priorities and associated costs for budget consideration on a biennial basis. 	<ul style="list-style-type: none"> • Conduct urban forestry activities as a citywide program with a de-emphasis on the roles of specific departments. • Examine canopy-cover effects on views, solar access and property values across different land-use types. • Review urban forestry staff functions, roles and responsibilities toward achievement of management efficiencies. • UFC will be responsible for tracking and documenting efficacy of UFMP implementation.

		strategies for UFMP implementation		
B2 Develop and implement resource management tools	<p>The UFMP will provide the basis from which departments can develop urban forest resource management system tools over time. These systems-based management tools include inventory and analysis of the tree resource itself, tree maintenance workload forecasting, documentation of work performed, performance metrics and processes for determining progress on performance goals. All information made available through such systems will be transferable into dollars to enable urban forest managers and policy makers to make well-informed decisions regarding the levels of funding for various urban forest management programs.</p>	<ul style="list-style-type: none"> • Update or create City tree inventories and link them to work record systems • Develop systems for documenting City tree crew's maintenance hours. • Develop performance metrics for City tree maintenance operations. • Budget development of the UFMP and selected early actions. 	<ul style="list-style-type: none"> • Develop an urban forest maintenance plan for all City-owned trees. • Develop a dynamic inventory process that can be continuously updated and maintained. 	<ul style="list-style-type: none"> • Link work record system with inventory so updates are frequent and automatic.
B3. Preserve and protect existing trees, and encourage new tree planting throughout the city by improving management of trees on private property.	<p>The primary mission of the City's urban forest staff is preservation, restoration, and enhancement of the urban forest so that it can be sustained in perpetuity. Accomplishing this task and meeting long-term canopy coverage goals will require many actions. Many of these will be policy/regulatory environment actions. This is especially true for private property, 76% of Seattle's land base. While a sensitive subject, the development and implementation of incentives and regulations for private land can be effective tools for encouraging tree preservation and new planting. The City will work with private property owners to encourage them through public</p>	<ul style="list-style-type: none"> • Review existing tree preservation and planting incentives and regulations. • Engage community stakeholders to identify opportunities and barriers for tree planting and preservation on private property. • Enforce existing regulations and incentives that preserve trees on private property. 	<ul style="list-style-type: none"> • Develop new incentive programs that encourage planting new trees on private property. • Research tree preservation and planting incentives, ordinances, policies and regulations that are working in other cities. • Establish incentives to promote the appropriate maintenance and preservation of trees on 	<ul style="list-style-type: none"> • Through education and regulation, implement preventative maintenance programs for all trees in the city • Create incentives for developers to adopt tree protection practices, including facilitating permitting processes. • Seek private and/or public funding to

	information and incentives to both plant new trees and preserve existing ones, and practice good stewardship through BMPs.	<ul style="list-style-type: none"> • Develop new regulations that require preservation of trees or planting new trees on private property. • Increase developers', builders' and private property owners' awareness about the value of trees and provide incentives for tree retention and management. 	<p>private property.</p> <ul style="list-style-type: none"> • Evaluate the effectiveness of incentives and regulations and make changes as needed. • Recommend regulations to protect landmark trees, building upon the current work of DPD. • Recommend regulations to protect trees on all property undergoing development including tree protection and retention requirements, again building upon the current work of DPD. 	encourage tree planting on private property.
B4. Model good stewardship in City practices	The City needs to be the leader and 'walk its talk' on the need to preserve, restore and enhance the urban forest. The City should be a model of excellent forest stewardship practices in order to effectively manage the trees it owns and to provide an example to the community by demonstrating sustainable urban forestry practices on all City projects.	<ul style="list-style-type: none"> • Continue to provide good examples of sustainability, such as forest restoration or tree friendly public works approaches that enhance trees and the general condition of the forest. • Conduct all City tree management practices to ISA or equivalent standards and encourage compliance by private industry. • Consistently follow up tree planting projects with maintenance reminders, training 	<ul style="list-style-type: none"> • Continue to revise and update City BMPs for tree and forest maintenance on a 5-year cycle (next revision due in 2009). • Expand pilot programs to salvage, distribute and reuse wood and tree chip products 	

		<p>opportunities and stewardship activities.</p> <ul style="list-style-type: none">• Expand opportunities like the 'Forest Stewards' element of the Green Seattle Partnership to provide quality training and enhance volunteer opportunities		
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Table 5. Goals and Recommended Actions for the Seattle Urban Forest Management Plan (Cont.)

Community Framework				
C1. Enhance public awareness of the urban forest as a community resource	<p>Experts are quick to point out that the urban forest cannot and will not survive without active interaction with and management by humans. For this active care, trees provide many social benefits including aesthetic/architectural, shade, color, fragrance, green in an otherwise gray environment and opportunities for recreation and even active stewardship. Sustainable urban forests require community involvement. For citizens to become active in caring for, enhancing and advocating for the urban forest, they must first be made aware of the benefits and value it provides. They also need to understand the challenges facing the urban forest and the actions they can undertake personally, or as groups, to enhance forest vitality.</p>	<ul style="list-style-type: none"> • Continue to provide volunteer stewardship opportunities through programs like the Green Seattle Partnership. • Use UFC vision as starting point to define and adopt a vision for the future of the City's urban forest. • Create a citywide approach to communicating about trees. • Develop communication tools that explain urban forestry benefits and programs, using promotional themes and ideas. • Provide all tree owners access to City tree maintenance BMPs. 	<ul style="list-style-type: none"> • Capitalize on the research being undertaken by others to quantify the financial value associated with the social benefits afforded by the urban forest. • Identify special trees and mark their historic, biological or other noteworthy traits with signs or other means. (Heritage Tree Program). • Involve community in inventories and assessments as a follow-up to neighborhood planning efforts and current outreach efforts. 	<ul style="list-style-type: none"> • Create tree curricula for K-12 schools, providing resources for both classroom and neighborhood-based learning. Use and build on existing programs (e.g. <i>City Among the Trees</i>). • Develop community service opportunities with schools and other institutions for urban forest stewardship projects.

<p>C2.</p> <p>Engage the community in active stewardship of the urban forest</p>	<p>In 2004, Seattle citizens contributed over 110,000 hours of outdoor volunteer service in parks alone. Some 70,000+ of those hours were in support of forest restoration projects and others were in support of neighborhood street tree planting projects and other greening type of activities. Implementation of the UFMP complete with the preservation, restoration and enhancement of Seattle's forests, cannot succeed without support of these many dedicated citizen stewards.</p>	<ul style="list-style-type: none"> • Engage the public with developing this UFMP. • Continue to support the Green Seattle Partnership to restore 2,500 acres of forested parklands • Expand volunteer stewardship opportunities. • Provide continued support to the existing 110 'Friends of' groups already providing volunteer support. • Add tree experts to the Mayor's Urban Sustainability Advisory Panel • Involve community in inventories and assessments as a follow-up to neighborhood planning efforts and current outreach efforts 	<ul style="list-style-type: none"> • Coordinate urban forest activities with neighborhood plans. • Promote expanded and coordinated urban forest efforts at a neighborhood level. • Coordinate City's urban forest services delivery with neighborhood programs and projects. • Explore funding opportunities with the business community and with regional donors, particularly for special projects identified in a management plan. 	<ul style="list-style-type: none"> • Expand City urban forest resources dedicated to neighborhood outreach p (e.g., free trees, Tree Steward Program, technical assistance). • Encourage/support neighborhood tree committees associated with district councils. Continue promoting tree advocate services on DPD design review panels. • Create resource centers at neighborhood offices, enlisting citizen foresters as assistants.
<p>C3.</p> <p>Promote citizen-government-business partnerships</p>	<p>Partnerships between city government and citizen or business groups can be of great benefit to the urban forest. Partnerships with nonprofit groups such as the Green Seattle Partnership can generate additional resources to take on major forest programs.</p> <p>Financial or volunteer labor contributions from private businesses have generated significant amounts of forest restoration and other tree planting.</p>	<ul style="list-style-type: none"> • Develop a coordinated approach to seek funding from sources such as local and regional foundations, industry and corporations. 	<ul style="list-style-type: none"> • Partner with nurseries and landscape industry to make quality information and plant materials available, particularly information to discourage the sale and planting of known non-native invasive plant species. • Institute a program to acknowledge and publicize contributions to urban forestry by citizens, businesses, institutions, and NGOs. 	<ul style="list-style-type: none"> • Facilitate opportunities to collaborate with universities and the private sector on urban forestry science.

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4. Goals and Actions by Management Units

Seattle's urban forest covers all 53,000+ acres of publicly and privately owned land within the city limits. Because of the obvious differences between urban spaces, streetscapes, parklands, remnant forests and other land-use types, the urban forest cannot be viewed as a single management unit.

Instead, it is a collection of management units that together form Seattle's urban forest ecosystem. We have defined nine of these management units (MU) for the plan. The MUs were selected based upon unique physical characteristics and conformity to land-use types the City uses for comprehensive planning. Using those land-use types allows for easy coordination of GIS mapping layers (Figure 3).

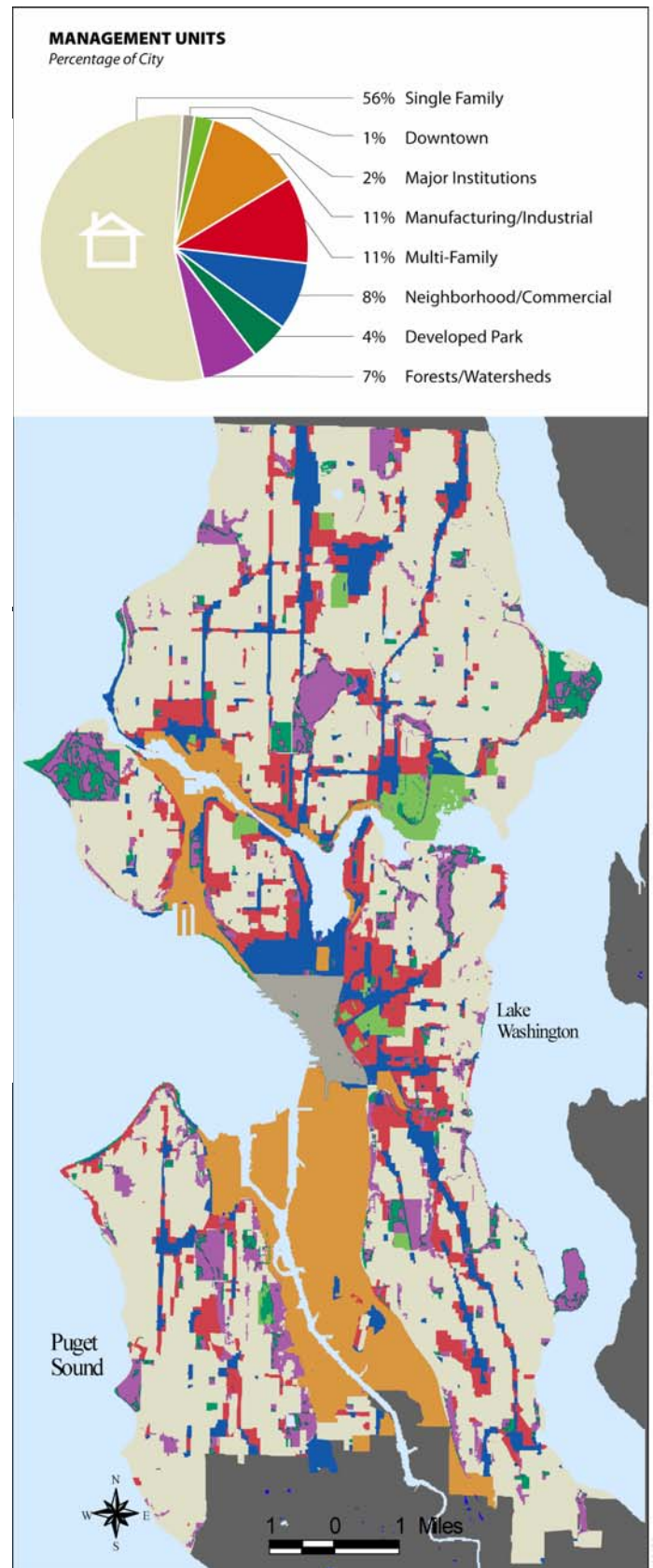
The following are the nine MUs for the plan:

1. Single-Family Residential
2. Multi-Family Residential
3. Commercial/Mixed Use Areas
4. Downtown Seattle
5. Transportation Corridors/Street Trees
6. Manufacturing/Industrial Property
7. Institutional Property
8. Developed Parks and Boulevards
9. Parks Natural Areas.

Management Units (MUs)

The purpose of defining urban forest management unit (MUs) is to allow analysis and planning for all of our forest resources at the level where real 'on-the-ground' actions can or are likely to take place.

Figure 3. Seattle's Urban Forest Canopy Cover: Distribution by MU



4.1. Methods

Two different methods have been used to determine the existing canopy cover data for each MU. In one method, the number of trees within the MU was derived by dividing the estimated average canopy width for all trees within the MU into the total canopy area for the unit. In this case, the total canopy area was determined through LIDAR data.

In two MUs— Rights of Way (ROW) and Developed Parks—existing tree inventory data (albeit dated) was used to derive the number of trees in the MU. Based upon currently available national and regional models, the number of trees within each unit was multiplied by estimated costs to plant an average tree in the unit, the cost to maintain the tree within the unit, and the benefits to be derived from each tree within the unit. Benefits were estimated based upon figures obtained from *Western Washington and Oregon Community Tree Guide: Benefits, Costs and Strategic Planting*.

Of specific importance to Seattle are the stormwater retention values and the air quality improvement values. These values were used to derive the following tables. Total values citywide are shown on [Table 6](#) for each MU and described individually in sections 4.2 through 4.10.

Table 6. Citywide Management Unit (MU) Data*

MU Statistics	Citywide	
	<i>Current</i>	<i>30-year Goal</i>
Acres in MU	54,324	
MU as % of City land base	100%	
Canopy coverage	18%	30%
Number of trees	1,377,500	2,026,600
<i>Plantings needed</i>		<i>649,100</i>
<i>One-time cost of plantings</i>		<i>\$114,200,000</i>
Maintenance Costs (yr)	\$14,054,300	\$21,116,300
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$20,643,000	\$30,215,000
<i>Air Cleaning Value (yr)</i>	\$4,894,000	\$7,047,000
<i>Carbon Sequestration (Tons CO₂)</i>	52,400	77,066
<i>Carbon Sequestration (Value \$)</i>	\$1,584,000	\$2,331,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$3,183,000	\$4,992,000
Net Benefit (All Benefits - All Costs) (yr)	\$30,304,000	\$44,585,000

*All values are based upon estimates and currently accepted models.

4.2. Single-Family Residential Property

Description

Approximately 56% of all property within Seattle is single-family residential. This element of Seattle's urban forest is found on private land and does not include any trees that may be growing along the adjacent street. The percentage of canopy cover within Seattle's single-family neighborhoods varies widely. Some neighborhoods are characterized by large trees species while other neighborhoods have canopy cover characteristic of smaller tree species (Table 7).

Because single-family properties occupy so much of Seattle's land base, they also provide the greatest opportunity for increasing the city's overall tree canopy cover. This fact is all the more important as more trees are removed from privately-owned single family zoned property.

The City can do more to encourage tree planting and retention through education, tree planting programs, and expanding the scope of a tree protection ordinance to include trees on private property. City tree planting programs such as the Tree Fund coordinated by the Department of Neighborhoods and Seattle City Light's Urban Tree Replacement Program have added thousands of new plantings along residential streets.

Table 7. Single-Family Residential Property MU Data*

MU Statistics	Single-Family	
	<i>Current</i>	<i>30-year Goal</i>
Acres in MU	29,921	
MU as % of City land base	55%	
Canopy coverage	18%	31%
Number of trees	473,300	823,500
<i>Plantings needed</i>		350,200
<i>One-time cost of plantings</i>		\$52,530,000
Maintenance Costs (yr)	\$4,733,000	\$8,235,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$7,100,000	\$12,353,000
<i>Air Cleaning Value (yr)</i>	\$1,420,000	\$2,471,000
<i>Carbon Sequestration (Tons CO₂)</i>	18,000	31,300
<i>Carbon Sequestration (Value \$)</i>	\$544,000	\$947,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$1,349,000	\$2,346,000
Net Benefit (All Benefits - All Costs) (yr)	\$10,413,000	\$18,117,000

*All values are based upon estimates and currently accepted models.

Current Condition

The current canopy coverage in this unit is 18%, or 5,331 acres. It consists of 473,300 trees, which collectively provide 56% of all canopy coverage in the city.

Desired Condition

The 30-year canopy cover goal for this unit is 30%.

Issues/Opportunities:

Rich Legacy of Large Trees

Many of Seattle's oldest and largest trees are located on single-family property. Preserving these specimen trees should be a priority for the City. Providing citizens with information on the value of these trees to Seattle should likewise be a priority. The City should consider expanding the scope of the Tree Protection Ordinance to apply to regulate removal of trees of a minimum tree diameter on all private property. Forming partnerships with agencies and business involved in property transfer would increase awareness of the City's tree preservation and canopy goals.

Significant Planting Potential

Single-family residential property represents over 56% of all the land in the city. It holds the greatest opportunity for tree canopy cover enhancement. Homeowners should be encouraged, perhaps via incentive programs, to plant additional trees on their property for their enjoyment and to benefit the overall community.

Standards of Tree Care

Too many trees on single-family property are harmed by poor maintenance practices such as tree topping, girdling, volcano mulching, changing the soil grade, and lack of water. Public information on tree maintenance practices is available from the City through printed material, classes, and on City web sites. However, too many tree care and landscape businesses do unprofessional work on trees and set a bad example for others.

Tree Planting Incentives

One element of the 1998 Millennium Woods Legacy Project was creating a partnership with the Washington State Nursery and Landscape Association to encourage residents to buy a tree at a discount. Through a private benefactor, over 3,000 \$25 coupons were made available to Seattle residents to be redeemed at local nurseries toward purchase of a tree(s). City Light has offered a similar program in the past with success. Programs like these not only provide incentive for homeowners to purchase and plant trees, they are an excellent opportunity to educate the public on proper tree selection, planting and care.

Fall Leaves and Other Debris

Sometimes homeowners decide to remove perfectly healthy trees because they drop leaves in the fall or other debris at other times of the year. There may be an opportunity for groups like the scouts or even Master Composters to volunteer or offer leaf collection services to clean up fall leaves and take them to a composting site. It's even possible that the City might be able to provide a location in the future for tree debris to be taken for recycling.

Goals and Actions:

Tree Resource

- Select tree to maximize canopy for the size of the tree planting space (i.e., large space with no overhead obstructions = large tree).
- Focus on tree preservation.
- Complete a more thorough tree inventory.

Management Framework

- Research Portland's private tree preservation program.
- Develop/increased incentives for tree preservation.
- Increase street sweeping frequency for leaf control. Change local regulation to allow citizens to place leaves in the street for City pickup (sweeper).
- Partner with Washington State Nursery and Landscape Association or others to provide free tree vouchers per the Millennium project.
- Implement "exceptional tree" program.

Community Framework

- Produce and distribute tree education materials that address tree concerns and guide good tree care practices.
- Include diverse representation on a new "Tree Board."
- Provide widely distributed education materials on tree stewardship and the value of planting and preserving trees.
- Provide directed tree education materials to realtors.
- Increase citizen participation in street tree planting and stewardship programs.

4.3. Multi-Family Residential Property

Description

About 10.7% of all property in Seattle is zoned multi-family, an area of over 5,746 acres. Multi-family residential properties tend to be located along major transportation corridors, near college campuses, and adjacent to the downtown core. The amount of available tree planting space is limited in some multi-family developments. In others, the tree canopy is more generous (Table 8).

Table 8. Multi-Family Residential Property MU Data*

MU Statistics	Multi-Family	
	Current	30-year Goal
Acres in MU	5,746	
MU as % of City land base	11%	
Canopy coverage	13%	20%
Number of trees	103,400	159,400
<i>Plantings needed</i>		<i>56,000</i>
<i>One time cost of plantings</i>		<i>\$19,600,000</i>
Maintenance Costs (yr)	\$1,240,800	\$1,912,800
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$1,299,000	\$2,002,000
<i>Air Cleaning Value (yr)</i>	\$325,000	\$501,000
<i>Carbon Sequestration (Tons CO₂)</i>	3,900	6,000
<i>Carbon Sequestration (Value \$)</i>	\$119,000	\$183,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$532,000	\$821,000
Net Benefit (All Benefits - All Costs) (yr)	\$2,275,000	\$3,507,000

*All values are based upon estimates and currently accepted models.

Current Condition

Multi-family properties are estimated to currently have 13% tree canopy coverage, about 8% of the city's total tree canopy cover. This equates to approximately 103,400 trees in the MU.

Desired Condition

The current canopy coverage in this MU is 13%. Our canopy cover goal for 30 years is 20%.

Issues/Opportunities:

Owner/Developer Education

Typically, much less tree space is available in multi-family developments than in single-family. The greatest opportunity for trees begins with design and the developer. Multi-family development design takes on many forms with some being much more conducive to the planting of trees. Incentive programs might allow variations on development regulations in return for planting and retaining trees.

Turnover Rates

Multi-family developments have high turnover rates. Because tenants are not owners and may not plan to stay in their unit very long, they are unlikely advocates for trees.

Goals/Actions:

Tree Resource

- Develop a list of tree species that would thrive in the often smaller planting spaces found within this MU.

Management Framework

- Consider incentives that would encourage the preservation and planting of trees.
- Consider applying some of the proposed 'Seattle Green Factor' strategies to this MU to expand the potential for additional trees and related greenery.

Community Framework

- Work with condominium home owner associations to educate these owners and encourage them to plant additional trees.
- Educate apartment building owners about the positive aspects of providing well-maintained trees and green spaces as part of their rental environment.

4.4. Commercial/Mixed Use

Description

This MU includes Seattle's commercial developments along the major transportation corridors and in various commercial hubs. This unit includes the private property within these commercial areas as well as publicly-owned and managed street trees (Table 9).

Table 9. Commercial/Mixed Use MU Data*

MU Statistics	Commercial/Mixed Use	
	Current	30- year Goal
Acres in MU	4,522	
MU as % of City land base	8%	
Canopy coverage	8%	15%
Number of trees	49,700	94,100
<i>Plantings needed</i>		<i>44,400</i>
<i>One time cost of plantings</i>		<i>\$15,540,000</i>
Maintenance Costs (yr)	\$994,000	\$1,882,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$624,000	\$1,182,000
<i>Air Cleaning Value (yr)</i>	\$156,000	\$295,000
<i>Carbon Sequestration (Tons CO₂)</i>	1,900	3,600
<i>Carbon Sequestration (Value \$)</i>	\$57,000	\$108,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$256,000	\$485,000
Net Benefit (All Benefits - All Costs) (yr)	\$1,093,000	\$2,070,000

*All values are based upon estimates and currently accepted models.

Current Condition

There are 4,522 acres of land within this MU, or about 8.5% of the total city land base. The current number of trees within the MU is estimated at 49,700 creating about 358 acres of canopy coverage. About 8% of the land within the MU has canopy coverage that contributes about 4% to the overall canopy coverage for the city.

Desired Condition

The opportunity for tree plantings in this MU is varied and generally more limited than in others. Historically, the majority of tree plantings in Commercial/Mixed Use areas are street trees. DPD landscape development and tree retention regulations guide the opportunity for canopy enhancement within Seattle commercial areas. Some of these areas are designated urban villages or urban centers for future land use. This distinction will have some bearing on

forest management opportunities within this MU, which has a 30-year canopy coverage goal of 15%.

Issues/Opportunities:

Increased Population Density

As Seattle moves toward an Urban Village model, increasingly it will be necessary to both plant and preserve trees in parts of the city to increase density. Choosing to both plant and preserve trees now will prepare the city for new residents. Strategic purchase of available openspace can help preserve wildlife habitat within dense residential areas.

Working with Business Owners

It's not uncommon for some business owners to look at trees as a problem or nuisance rather than a benefit. Cleaning up fall leaves takes time. Trees must be well-sited and appropriate species selected for a successful commercial streetscape. However, repeated studies have shown that shoppers prefer tree-lined streets and, even in Seattle, the shade produced by trees can be truly appreciated on a hot summer day. Opportunities exist to work with business owners to better educate them about the value of trees in a commercial setting and to partner with the City to make repairs and improvements.

Green Roofs and Parking Lots

This MU typically is associated with a high percentage of area given to building footprints (roofs) and parking lots. Opportunities exist, possibly through incentive programs, to increase the green associated with these necessary elements to effectively increase the canopy coverage in the MU.

Goal/Actions:

Tree Resource

- Develop a desired tree species palette for commercial areas that takes into consideration the needs and concerns of business owners.
- Place a high value on preserving existing trees via monitoring construction practices, encouraging professional maintenance practices, educating business owners on trees' value to their business and community.
- Work with local businesses and business associations to develop programs for planting additional trees.
- Over time, achieve desired canopy coverage goal for the MU.

Management Framework

- Undertake an inventory of existing trees within the Commercial/Mixed Use MU and document in a citywide database.
- Enforce existing code requirements regarding tree preservation and planting.

- Explore existing codes to determine existing authority over private trees and consider expanding if possible.
- Establish tree planting guidelines/standards for Urban Villages and other areas designated for greater population density.
- Focus forested open space acquisitions and development of neighborhood scale parks with trees in areas designated for greater population density.
- Consider expansion of Neighborhood Business District grants for tree planting.
- Encourage other means of incorporating trees into this MU through 'green roofs' and green parking lots.
- Consider providing incentives for adding trees and other landscape assets as part of a building renovation or construction project.

Community Framework

- Make tree preservation and planting a part of the District Council discussions and have City staff prepared and available to participate in those discussions.
- Create or modify existing education programs for business owners, property owners and residents regarding the value of planting and preserving trees.
- Make tree maintenance brochures and standards available to property owners so that they will know how trees should be maintained and will hire qualified arborists for tree work.
- Develop commercial zone "branding."
- Provide parking beneath buildings to provide more tree planting space at the street level.
- Whenever possible, notify the public in advance of the need to remove trees.

4.5. Downtown Seattle

Description

Trees in this MU are found in the City's urban core (Table 10). Most of the trees in downtown Seattle are located within the street ROW. In addition to limited planting space, the downtown environment can be especially harsh. It has very poor soils, poor drainage, a wind tunnel effect between high-rise buildings and abuse from human activity. The national average lifespan of an urban tree is 13 years, 6 to 7 years for trees in the central business district.

Table 10. Downtown Seattle MU Data*

Management Unit Statistics	Downtown	
	Current	30-year Goal
Acres in MU	811	
MU as % of City land base	1%	
Canopy coverage	9%	12%
Number of trees	9,700	13,500
<i>Plantings needed</i>		3,800
<i>One time cost of plantings</i>		\$1,330,000
Maintenance Costs (yr)	\$485,000	\$675,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$97,000	\$135,000
<i>Air Cleaning Value (yr)</i>	\$49,000	\$68,000
<i>Carbon Sequestration (Tons CO₂)</i>	400	500
<i>Carbon Sequestration (Value \$)</i>	\$11,000	\$15,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$56,000	\$79,000
Net Benefit (All Benefits - All Costs) (yr)	\$213,000	\$297,000

*All values are based upon estimates and currently accepted models.

Current Condition

This MU is 810 acres or about 1.5% of the city land base. The current tree canopy coverage is about 70 acres, or about 9%, a fair-to-good percentage by national standards. The estimated 9,656 trees in this unit are equal to less than 1% of the city total, but they are critical in terms of their ability to soften the harsh urban environment. Trees in downtown Seattle are frequently under stress due to limited planting space and other harsh conditions. Given these environmental stresses, the average tree in this MU is typically smaller than in other units and has a shorter lifespan. Changes in development and land-use patterns downtown can also be a challenge to tree preservation.

Desired Condition

As stated, the current canopy cover percentage for this MU is 9%. Despite the challenges of planting trees in downtown Seattle, our canopy cover goals for this MU are 12% within 30 years. These numbers are within expected national averages.

Issues/Opportunities:

Canopy Cover Percentage

The current 9% canopy cover for downtown Seattle is roughly half of that recommended by American Forests. Finding planting space to achieve 15% canopy coverage in the downtown core will be a significant challenge. The availability of new planting sites for street trees is limited. It's possible that advancements in 'green building' (roofs) technology or new and innovative planting incentives and strategies like the proposed 'Seattle Green Factor' might provide some of the benefits that would otherwise be provided by trees thus allowing for a more modest actual tree canopy goal for the downtown area.

Perceptions of Business Owners

It's not uncommon for business owners to have strong opinions about trees. Some are strong advocates for trees and others are not, or are even opposed to having trees near their businesses. Some business owners raise concerns about trees blocking signs, creating debris or producing too much shade. For other business owners, the benefits trees provide are very important to their business environment. Without a doubt, there is considerable opportunity to provide more and better information to Seattle's downtown businesses on the value that trees can bring to commerce.

Tree Protection

Tree protection in downtown Seattle is very important because growing trees in the urban core is difficult. Growing trees to a large size in healthy condition is particularly challenging.

Illegal Activity and Trees

In recent years the relationship of vegetation and illegal activities has resulted in the modification of several downtown park landscapes. The need for public landscapes that are safe and inviting to use has led to new terms like CPTED, 'Crime Prevention through Environmental Design' which have become part of our landscape design and management lexicon. The process of making parks safer for legal use can impact trees including pruning, removal, replanting in alternate locations and/or replanting with different species.

Tree Planting Incentives

Along with greater public education, it's desirable to offer incentives to business and property owners in the downtown core to encourage them to seek opportunities to plant more trees. Most planting opportunity, of course, is within street ROW. A continuing SDOT challenge will be to work with business and property owners to plant more street trees.

Goals and Actions:

Urban Forest Resource

- Preserve trees in this MU whenever possible.
- Due to the challenges of the downtown planting environment, select tree species with particular care to help ensure long-term success.

Management Framework

- Develop landscape design guidelines that will consider safety, maintainability and other factors as a means of helping to preserve and/or enhance tree plantings.
- Promote designs that create more space for tree growth above and below ground.

Community Framework

- Meet with Downtown Business Association(s) to discuss tree canopy and preservation goals.
- Seek partnerships and financial support from downtown businesses in order to plant additional trees.
- Also seek financial support from downtown for the maintenance of trees.

4.6. Transportation Corridors/ Street Trees

Description

Of the over 130,000 trees along Seattle's streets, SDOT maintains about 35,000. The remaining 95,000 the City regulates by permits SDOT issues for tree removals and new plantings within street-side planting strips. Existing canopy coverage percentage in this MU is 16% with a goal of 20% (Table 11).

Table 11. Transportation Corridors/Street ROW MU Data*

Management Unit Statistics	Transportation Corridors/Street ROW	
	<i>Current</i>	<i>30-year Goal</i>
Acres in MU	14,412	
MU as % of City land base	16%	
Canopy coverage	16%	24%
Number of trees	130,000	195,000
<i>Plantings needed</i>		65,000
<i>One time cost of plantings</i>		\$26,000,000
Maintenance Costs (yr)	\$3,900,000	\$3,900,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$1,820,000	\$2,730,000
<i>Air Cleaning Value (yr)</i>	\$780,000	\$1,170,000
<i>Carbon Sequestration (Tons CO₂)</i>	4,900	7,400
<i>Carbon Sequestration (Value \$)</i>	\$150,000	\$225,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$110,000	\$165,000
Net Benefit (All Benefits - All Costs) (yr)	\$2,860,000	\$4,290,000

*All values are based upon estimates and currently accepted models.

SDOT also contributes directly to the population of SDOT-managed street trees via preservation and installation of new trees in conjunction with most SDOT capital improvement projects. Additionally, SDOT works cooperatively with DPD to ensure preservation, replacement, planting of new trees and maintenance of trees required by land-use code for private development projects. SDOT also partners with the nonprofit group Plant Amnesty on the nomination of 'Heritage Trees.'

The first street tree inventory of 1992 accounted for 84,000 street trees. A random sampling performed in 1998 estimated the number of street trees to be 98,000, along with over 50 acres of SDOT-maintained ROW landscaping.

Current Condition

Diversity

Street trees have good species diversity except that sweet gum and Norway maple comprise 13.5% and 12.6%, respectively, of trees in retail and commercial zones. Purple-leaf plums comprise 11.2% of residential street trees. More than 10% in any one species is generally discouraged. Average spacing between residential street trees is 152 feet, about 3 times the desirable distance for a medium to large maturing tree.

Distribution

Seattle's street trees have a broad range of size classes (a proxy for age) although the number of 20-inch-diameter (large) trees has decreased. More trees are being planted than lost, precluding any sudden barrenness as trees reach the end of their lifespan. In residential areas, the size distribution of street trees has been virtually unchanged for a decade. Nearly half of these trees have diameters of 5 inches or less and are relatively young (Table 12). Many others are larger, with diameters of 6 to 20 inches, yet are young enough to provide benefits and services for many more years. In residential areas off-street trees are on average generally larger than on-street trees, but no data have been collected on their sizes.

Table 12. Diameter Classes of Seattle's Residential Trees

Diameter	0 - 5"	6 - 12"	13 – 20"	21 – 30"	>30"
Original inventory	38,232 (47.2%)	29,808 (36.8%)	8,424 (10.4%)	3,240 (4.0%)	1,296 (1.6%)
Current sampling	63,008 (48.9%)	48,190 (37.4%)	13,400 (10.4%)	2,577 (2.0%)	1,675 (1.3%)

SDOT estimates that about 20% of street trees are candidates for removal due to improper location (large trees under utility lines or insufficient growing space) or structural and health issues. SDOT currently removes trees only if they pose an imminent hazard or if removal allows the City to take advantage of opportunities to remove or replace trees as part of a larger planting project. SDOT also frequently removes privately maintained unhealthy trees when they become imminent hazards.

Desired Goals

SDOT's goals are to have a healthy mix of species and age distribution, with a maximum of 10% for any one species. New trees should be planted to meet canopy the cover goals. A maintenance cycle for small trees of 3 to 4 years and 7 to 8 years for larger trees should be pursued. SDOT will also develop a tree management plan, including a hazard tree mitigation program to ensure that street trees are being managed proactively. Trees planted in

substandard tree pits will be identified and the pits expanded if feasible. If not, the trees will be prioritized for removal and replanting where conditions warrant.

Issues/Opportunities:

Conflicting Tree Management Responsibilities

Although 75% of street trees are owned by adjacent property owners and hence their responsibility to maintain, many owners are unable or unwilling to maintain trees. The SDOT tree crew is frequently dispatched to prune or remove trees that pose a hazard to pedestrians and motorists. About 25 % of crew time is spent responding to such calls. Many other property owners are unaware of their maintenance responsibilities.

Many opportunities are available to improve management of the street tree program. In particular, the public and policymakers are increasingly aware of the importance of sustainably managing our urban forest. Recognition is growing for the environmental, economic and aesthetic value of trees. An aggressive public education program can increase understanding and build support for a strong maintenance program as the most effective way to preserve our urban forest. Furthermore, a tradition of civic mindedness among Seattle citizens provides opportunities to build strong volunteerism to supplement SDOT's maintenance of street trees.

Conflicts with Other ROW Infrastructure

Providing space within the limited ROW to plant trees is a major challenge. Trees must compete for space with sidewalks, underground utilities, overhead power lines, the desire to retain views, and a variety of street furniture, such as bus stops, curb space for vehicles, traffic signs, etc. Additionally, many planting strips are too small to accommodate large trees and cannot be expanded. It will be a challenge to plant the 65,000 new trees recommended in this plan to meet canopy cover goals citywide.

Inadequate Regulations

The current street tree ordinance is inadequate to properly regulate the planting, pruning and removal of trees in the ROW. For example, there are no penalties the City can levee against a citizen or property owner who removes or otherwise damages a privately-maintained tree in the ROW. Similarly, private companies working on ROW trees are not required to have qualifications to ensure proper pruning. The result is that many trees are structurally damaged by companies with little or no knowledge of proper pruning techniques. The existing ordinance should be strengthened to enable better management of street trees, and protect trees from these types of activities.

Goals and Actions

We have used the urban forest sustainability model to present goals and actions the City should take to create a sustainable forest. The actions described below and the timeframe within which they occur reflect a two-part approach: 1) reverse the trend in which about 4% of trees are lost each year to development, and 2) increase the number of street trees and canopy over the long term.

Urban Forest Resource

- Implement a 2-for-1 tree planting program.
- Increase number of trees pruned annually by 20% over 2005.
- Continue to evaluate and update SDOT's plant list.
- Initiate phase 1 of a landscape assets inventory and condition assessment.
- Develop a risk assessment plan.
- Continue to identify and designate landmark and heritage trees.
- Initiate phase 2 and 3 of the landscape inventory and condition assessment.
- Update existing tree inventory.
- Reduce pruning cycle from current 18-year cycle to acceptable national standards.
- Implement a hazard tree abatement program.

Management Framework

- Develop a budget adequate to implement ROW trees and landscaping management over the next 5 years.
- Revise the street tree ordinance; submit it for management and executive review.
- Increase enforcement of BMPs; pass information among tree care and landscape companies.
- Study the feasibility of placing all ROW trees under the SDOT management.
- Explore creative financing mechanisms to ensure alternative funding to supplement general fund revenues.
- Develop a long range (20 to 30 years) street tree management budget.
- Identify and establish dedicated funding sources for street trees.
- Consider SDOT maintenance of all ROW street trees.

Community Framework

- Increase and improve education of the public on tree care responsibilities.
- Continue to promote Heritage Tree program.
- Continue to promote Arbor Day / Tree City USA.
- Develop tree information documents in languages that reflect the diversity of Seattle.
- Develop a plan for community involvement in tree management activities.
- Educate developers in tree retention benefits and techniques to implement a community involvement plan.

4.7. Manufacturing/Industrial Property

Description

The industrial areas of Seattle comprise nearly 11% of the city land base, or about 6,214 acres. The tree planting opportunities within the city's industrial areas vary widely but are generally fairly limited. A high percentage of property in industrial areas is needed for access, egress and circulation space for large trucks and parking. These requirements also impact the opportunity for street tree plantings (Table 13).

Table 13. Industrial Property MU Data*

MU Statistics	Manufacturing/Industrial	
	Current	30-year Goal
Acres in MU	6,214	
MU as % of City land base	11%	
Canopy coverage	8%	10%
Number of trees	68,100	86,200
<i>Plantings needed</i>		<i>18,100</i>
<i>One time cost of plantings</i>		<i>\$5,430,000</i>
Maintenance Costs (yr)	\$2,043,000	\$2,586,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	<i>\$855,000</i>	<i>\$1,083,000</i>
<i>Air Cleaning Value (yr)</i>	<i>\$341,000</i>	<i>\$431,000</i>
<i>Carbon Sequestration (Tons CO₂)</i>	<i>2,600</i>	<i>3,300</i>
<i>Carbon Sequestration (Value \$)</i>	<i>\$78,000</i>	<i>\$99,000</i>
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	<i>\$224,000</i>	<i>\$283,000</i>
Net Benefit (All Benefits - All Costs) (yr)	\$1,498,000	\$1,896,000

*All values are based upon estimates and currently accepted models.

Current Condition

The industrial areas currently have approximately 68,100 trees. This equates to 8% existing tree canopy cover, or about 491 acres of canopy, about 5% of the city's total coverage. Many trees in this MU are in compromised condition due to the harsh growing environment.

Desired Condition

The 30-year tree canopy coverage goal for this MU is 12%.

Issues/Opportunities:

Finding Space for Trees

Seattle's industrial areas are perhaps the biggest challenge to tree canopy enhancement. They are very harsh environments. Because trucks need access and egress, many ROW planting strips are not available for trees. As well, most businesses seem to maximize their available space for business purposes leaving very little land available for trees. However, there are still planting spaces available. As with downtown Seattle, the greatest opportunity for new trees, although limited, is to maximize street tree plantings in the ROW.

An Opportunity for Tree Planting Incentives

The industrial area probably presents one of the best opportunities for tree planting incentives. Incentives likely provide the best vehicle to entice business owners to plant their own trees. While a significant increase in the canopy coverage percentage in the industrial area may be wishful thinking, it should nevertheless be given a high priority. In this environment, a few additional trees would have significant visual impact.

Inconsistent Tree Maintenance

Perhaps because trees aren't seen as a primary need in the industrial areas, tree maintenance is good in some locations while only fair to outright brutal in others. A campaign to educate business owners about proper tree maintenance might save many trees that would otherwise become victim to poor maintenance.

Goals and Actions:

Urban Forest Resource

- Locate and quantify potential tree planting sites.
- Focus new plantings on "Industrial Landscape Streets."
- Select tree species carefully.
- Select planting locations carefully.
- Protect existing trees.

Management Framework

- Review current planting requirements and exemptions.
- Research what other cities have done in their industrial areas.

Community Framework

- Create tree planting incentives with business owners.
- Develop and implement a tree planting education program for business owners.
- Engage the Office of Economic Development and the Freight Movers in any tree planting discussions.

4.8. Institutional Property

Description

Hospitals, university, and college campuses comprise the Institutional Property MU. For the purpose of this plan, we have also included Seattle Public Schools. The 1,103 acres of institutional property constitute 2.1% of the city's land base. The landscapes found on these properties vary widely in design and use, often containing many park-like plantings, amenities and features, including appearance ([Table 14](#)).

Table 14. Institutional Property MU Data*

MU Statistics	Major Institutions	
	<i>Current</i>	<i>30-year Goal</i>
Acres in MU	1,103	
MU as % of City land base	2%	
Canopy coverage	15%	20%
Number of trees	14,600	19,600
<i>Plantings needed</i>		<i>5,000</i>
<i>One time cost of plantings</i>		<i>\$1,250,000</i>
Maintenance Costs (yr)	\$365,000	\$490,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$219,000	\$294,000
<i>Air Cleaning Value (yr)</i>	\$58,000	\$78,000
<i>Carbon Sequestration (Tons CO₂)</i>	600	800
<i>Carbon Sequestration (Value \$)</i>	\$17,000	\$23,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$27,000	\$36,000
Net Benefit (All Benefits - All Costs) (yr)	\$321,000	\$431,000

*All values are based upon estimates and currently accepted models.

The trees found on these institutional properties may or may not be inventoried. They are managed as individuals and as groupings, usually within a landscape setting. Some of these trees are of significant size and character and highly valued by students, staff, visitors, and patients receiving medical care as well as providing nesting sites and habitat for birds.

Current Condition

Seattle's institutional lands currently have approximately 14,600 trees. Canopy coverage is 15%, equaling 164 acres, or about 2% of the city's total tree canopy. Like parklands, trees in institutional properties have considerable species diversity and are found in all sizes, many

quite large. It is not known which institutions have tree inventories and to what extent the trees are actively managed.

Desired Condition

Institutional lands are typically ‘designed’ landscapes. The selection of tree species and their location in the landscape must be thoughtful. We feel, however, that planting opportunities do exist throughout the range of institutional properties. The 30-year canopy coverage goal for this MU is 20%.

Issues/Opportunities:

A Source of Significant Trees

Institutional properties represent a small percentage of Seattle’s acreage, but they contribute to the city’s tree canopy in a significant way. Many of these properties, such as the major college campuses, already have many beautiful and large trees. Some of these properties also have space available for additional tree planting.

The Challenge of Maintenance

The level of grounds and tree maintenance can be quite variable between institutional campuses. When budgets are tight, maintenance may be reduced in lieu of reducing budgets for educational programs. This often can have the double impact of reducing funding for tree preservation as well as new tree planting.

Goals and Actions:

Urban Forest Resource

- Optimize age and species diversity.
- Work with institutional land managers to preserve existing trees.
- Encourage institutional land managers to focus on replanting removed trees first providing that the current function of the landscape can accommodate the tree(s).

Management Framework

- Protect existing trees and encourage tree planting.
- Maximize opportunities for wood and byproduct salvage and reuse.

Community Framework

- Engage the institutional community as urban forest partners.
- Identify and work with the largest institutions first.
- Provide opportunities for education based groups such as fraternities, sororities and clubs to become involved with planting trees on their campuses.

4.9. Developed Parks and Boulevards

Description

Since it was founded in 1884, Seattle Parks and Recreation has grown to over 400 parks and park-owned boulevards on over 6,300 acres of property. Of this total, about 2,400 acres are classified as ‘developed parklands or ‘park-owned boulevards’. Developed properties have been developed for a specific use, are actively maintained, and are not in a natural state. Over 90,000 trees are located within these developed parks and boulevards (Table 15).

Table 15. Developed Parks and Boulevards MU Data*

MU Statistics	Parks - Developed Sites	
	Current	30-year Goal
Acres in MU	2,400	
MU as % of City land base	4%	
Canopy coverage	19%	25%
Number of trees	90,000	118,400
<i>Plantings needed</i>		28,400
<i>One time cost of plantings</i>		\$11,360,000
Maintenance Costs (yr)	\$1,350,000	\$1,776,000
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$1,350,000	\$1,776,000
<i>Air Cleaning Value (yr)</i>	\$270,000	\$355,000
<i>Carbon Sequestration (Tons CO₂)</i>	3,400	4,500
<i>Carbon Sequestration (Value \$)</i>	\$104,000	\$137,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$256,000	\$337,000
Net Benefit (All Benefits - All Costs) (yr)	\$1,980,000	\$2,605,000

*All values are based upon estimates and currently accepted models.

Specific recreation amenities found within this MU include sportsfields, picnic facilities, play areas, maintained lawns, shrub beds and other plantings, parking lots, boat launches and numerous other typical park amenities. These facilities are typically maintained on a routine (daily) basis. These properties are also heavily used and replacement of assets due to use and sometimes abuse is not uncommon.

Current Condition

The urban forest in this MU tends to be made up of individual or small groupings of trees rather than large stands such as would be found in a natural area. These trees need to be individually

inventoried and managed. The size and species composition varies widely. Many of these trees are now of great size. Because the park system continues to grow, smaller trees also constitute a part of the standing tree inventory. Hazard tree mitigation is a high priority within this MU because many trees are located in high-use facilities. On average, park trees are currently on an 18-year maintenance cycle. The current canopy cover percentage within this MU is 19%.

Desired Condition

Trees in Seattle's Developed Parks and Boulevards MU need to continue to represent considerable species and age diversity. The 30-year canopy cover goal for this MU is 25%.

Issues/Opportunities:

Tree Maintenance

Currently, Parks has three, 3-person tree crews. One of these crews is funded through the Pro Parks Levy and the other two are general fund crews. Each crew is fully outfitted with an aerial lift truck, support truck and a large chipper. The work unit also has a stump grinder. The current pruning cycle for these crews is 18 years. It is recognized that a preferred pruning cycle is 5 to 6 years depending on location, indicating a need for additional tree maintenance resources. The \$80,000 spent each year on hazard tree removal and replanting is a strong indicator that the current pruning cycle is leading to the premature death of park trees. Park staff estimate that \$900,000 of additional resources are required each year to meet the preferred pruning cycle. (This assumes continuation of the Pro Parks Levy-funded tree crew.)

Current Replanting Capacity

Currently, Parks lacks a single, well-defined plan for tree replacement. Trees are removed from some parks without replacement. However, new capital projects typically do include trees as do major maintenance funded landscape restoration projects. The landscape enhancement element of the Pro Parks Levy also includes the planting of trees. A modest number of trees are planted each year within Parks' general fund programs. Still, these planting programs lack a coordinated plan that will ultimately ensure that trees removed from any park are ultimately replaced if so desired. New tree planting should focus first on replacement trees so that the original architecture of a park can be restored as desired.

Tree Preservation

Tree preservation in parks is more than simply acquiring additional maintenance resources. Situations arise in which park trees conflict with park use, CIP projects, and park safety. When this occurs, it is important that consideration be given to protection and preservation of park trees and other vegetation. If trees have to be removed, consistent with City tree policy, they should be replaced at the original site at a 2-to-1 ratio or at an alternate location as close as possible.

Hazard Trees

For many years, Parks had just one tree maintenance crew for all 90,000+ trees in the system. As a result, many trees prematurely declined and are standing hazards. In 2000, Parks implemented a Hazard Tree Mitigation Program to methodically locate and remove trees that are most hazardous. This program has generated controversy because many large trees have been removed. However, the nearly hollow shells left behind show the need to remove the hazard.

Wood and Green Waste Recycling

It is currently estimated that Parks alone produces the equivalent of over 2,500 cubic yards of chipped wood mulch annually. In addition, a larger amount of so-called 'clean-green' waste is produced through maintenance operations and hauled to private vendors for composting. In turn, the City often buys back the composted material for use in Seattle landscapes. While most wood and green waste products are recycled, it is costly to do so. In 2005, an interdepartmental committee was formed to identify options for a better coordinated and more efficient process for dealing with these materials. That committee is first considering options for wood by-products.

Tree Species Selection

Because most parks have substantial areas for planting of trees, large, long-lived trees should be the preferred choice.

Goal/Actions:

Urban Forest Resource

- Inventory existing trees.
- Continue to plant new trees and to replace trees that have been removed.

Management Framework

- Determine annual maintenance requirements.
- Purchase or develop a tree management software system to track work performed on park trees.
- Work within the City budget to request desired tree maintenance resources.
- Train staff in tree protection practices.
- Work within the City budget to request desired tree maintenance resources.
- Develop BMPs for saving trees.
- Provide public education regarding rationale for tree removals.
- Link Vegetation Management Plan hazard tree needs to the work order system in priority order for removal.

Community Framework

- Increase public education information on "Living Alongside Park Trees."
- Work with the business and nonprofit (Park Foundation) community to create a tree donation account.

4.10. Parks Natural Areas

Description

The property in this MU is in public ownership and includes Seattle's true remnant forests typically located within parklands and undeveloped ROWs. These properties include established forests, riparian corridors, meadows, wetlands, and portions of parks that are in a natural state of varying ecosystem value. This MU contains a total of 3,200 acres. Much of it is steep hillsides and watershed ravines (Table 16).

Table 16. Parks Natural Areas MU Data*

MU Statistics	Parks -Natural Area	
	<i>Current</i>	<i>30-year Goal</i>
Acres in MU	3,608	
MU as % of City land base	7%	
Canopy coverage	64%	80%
Number of trees	568,700	711,900
<i>Plantings needed</i>		<i>143,200</i>
<i>One time cost of plantings</i>		<i>\$7,160,000</i>
Maintenance Costs (yr)	\$2,843,500	\$3,559,500
Benefits (yr)		
<i>Stormwater Mitigation Value (yr)</i>	\$9,099,000	\$11,390,000
<i>Air Cleaning Value (yr)</i>	\$2,275,000	\$2,848,000
<i>Carbon Sequestration (Tons CO₂)</i>	21,600	27,000
<i>Carbon Sequestration (Value \$)</i>	\$654,000	\$819,000
<i>Other Benefits (Energy, Aesthetics, & etc)</i>	\$483,000	\$605,000
Net Benefit (All Benefits - All Costs) (yr)	\$12,511,000	\$15,662,000

*All values are based upon estimates and currently accepted models.

This MU also contains most of Seattle's salmon-bearing streams. About 8 miles of urban creek area lies within 800+ acres of watersheds. The streams include Piper's, Venema, Thornton, Longfellow, Schmitz, Fauntleroy and Taylor creeks. In cooperation with Parks, SPU has undertaken numerous projects within these creek systems to remove barriers to fish passage and to generally improve habitat quality.

Current Condition

Because this unit contains a wide variety of ecosystem types, the 'state of the forest' cannot be easily defined. In general, however, Seattle's forests are about 70% deciduous and 30%

coniferous, very likely an exact reversal of what would have been found 150 years ago. Many of these second growth deciduous forests, primarily big-leaf maple and red alder, are past their prime and are in decline. Only Seward Park and Schmitz Preserve still have stands of true old growth Douglas fir forest. Recreation use within the unit is generally passive including the city's 70+ miles of trails.

Desired Condition

The lands within this unit have the greatest potential for stormwater mitigation, enhancement of water quality, carbon sequestration and wildlife habitat. However, in their current state, they are unable to provide these ecological services at a level that would be expected of fully functioning ecosystems. It is vital that the forest restoration work begun in the late 1980s—now stepped up considerably through the Green Seattle Partnership—be continued. The goal remains to restore 2,500 acres of these forests and watersheds by 2025. That means the major invasive plant species have been removed, replanting with native species has taken place, and community volunteer groups have been established to assist with long-term maintenance of the sites. In addition, the City resources required to monitor, maintain, and manage the restored forests will be in place. The current canopy cover percentage in this MU is 64%. The 30-year canopy cover goal is 80%.

Issues/Opportunities:

The Impacts of Logging Operations

In the early 1900s, nearly all the huge Douglas fir, Western red cedar and Western hemlock in the Seattle area were milled into lumber. As a result, no conifers were left to provide a seed source to renew the coniferous forest. Instead, deciduous native alders and big-leaf maples claimed the land and became the second-growth remnant forests (or woodlands) of today. These deciduous trees are relatively short-lived and many are already nearing the end of their lifespan. As they decline, they create openings in the forest canopy allowing sunlight to enter. When that happens, it produces ideal conditions for non-native species like English ivy and Himalayan blackberry to invade the forest. As these invasives take over, the ecology of the forest is radically altered, and the many benefits that the forest provides are diminished. Today, over 70% of Seattle's remnant forests have some invasive plants present and about 50% are moderately to heavily invaded according to SUNP data.

The Loss of Woodland Area

Recent trends in Seattle's woodland areas indicate significant canopy cover change. Between 1972 and 1996, areas with at least 20% canopy cover decreased by more than half (from 19.5% to 8.4% of Seattle's total land area). Further, much of the lost canopy was well distributed across the catchment areas of our urban watersheds where it had maximum effectiveness in reducing stormwater volumes and peaks, could absorb air and water pollutants from wide areas, and provided larger and better connected areas for wildlife.

An Ambitious Plan to Restore Seattle's Forests

Although seriously compromised, Seattle's remnant forests remain an extremely valuable component of Seattle's overall urban forest ecosystem. The Urban Forest Sustainability Model objective to "maintain wildlife corridors to and from the city" is adequately fulfilled by Seattle's woodland. Birds and small mammals (up to the size of coyotes, raccoons, fox and opossums) move freely. Similarly, the creeks within these forests are witnessing increased populations of fish and other aquatic life, thanks in large part to the efforts of many dedicated volunteers and creek restoration projects funded by SPU. However, one only needs to look at the condition of the flora in many of the so-called forests to realize that the habitat values are soon to change for the worse forever if restorative action isn't taken soon. As mentioned earlier, to enhance forest restoration efforts, the Green Seattle Partnership will restore 2,500 acres of these forests by the year 2025.

The Role of the Community

The community must play a large role if urban remnant forests are to be restored and sustained in perpetuity. In 1994, Parks established a forest restoration working model that was then, and remains today, about 95% dependent on community volunteer support for success. In 2004, community volunteers contributed over 50,000 hours to the restoration of Seattle's forests and trails. The Green Seattle Partnership will continue this model well into the future, with its goal of 100,000+ annual hours of volunteer support at the program peak in 2010.

Private Views and Public Trees

Parks owns and manages many acres of forests on steep hillsides. Many homes are located above the forests. These homes in many cases would have dramatic vistas of mountains and water were it not for City-owned trees. Park's policies on private views have varied over the years. Twenty years ago, trees were allowed to be topped for views at the homeowner's expense. Because topping kills trees, Parks ended the practice. Currently, City park trees can be pruned for private views but cannot be topped or removed solely for that purpose.

Goals and Actions

Urban Forest Resource

- Continue to work with the SUNP to inventory, assess and validate existing and new data on Seattle's remnant forests.
- Continue to restore Seattle's forest lands via the Green Seattle Partnership and other means.
- Establish a standalone riparian corridor forest inventory.
- Establish evergreen canopy guidelines to support watershed protection and wildlife habitat.
- Use more understory species, where appropriate, for increased and multi-layered canopy.

Management Framework

- Establish a common nomenclature for describing forest assets and the services they provide.
- Develop BMPs for forest restoration work and implement as part of the Green Seattle Partnership.
- Develop database management tools to assist with monitoring, documentation and evaluation of forest restoration work.
- Develop the framework for long-term management of Seattle's remnant forests including support for volunteer stewardship.
- Establish long-term funding for maintenance of Seattle's remnant forests.

Community Framework

- Increase volunteer outreach education.
- Engage additional business/corporate sponsors for forest restoration.
- Nurture existing volunteer support groups.

5. Moving Forward: Implementing the Plan

The Urban Forest Management Plan is a roadmap for a strategic approach to manage Seattle's urban forest, in perpetuity. The general approach to guide overall plan implementation will include:

- Develop program-wide annual workplans specifying actions, outcomes, responsible departments and staff, and budget implications, based on the goals and recommended actions in this plan.
- Develop program-based budgets that bring together all of the initiatives and proposals from the different departments in support of the City's urban forest goals to allow for program-wide consideration of priorities.
- Create a performance management system that will include urban forest health and management benchmarks as well as a system for reporting results within the City and the community and for informing budget decisions.
- Create a process for updating the plan every 5 years including a mechanism for community input into the update.

A broad range of actions that will forward the goal of a sustainable urban forest in Seattle over the next 30 years have been presented. When completed (following public review and comment) this section will identify key actions that have been prioritized and recommended for implementation over the next 1 to 3 years.

Appendix A: Source of Ecological Services Numbers

Detail from: *Western Washington and Oregon Community Tree Guide: Benefits, Costs and Strategic Planting*, E. Gregory McPherson et al, Center for Urban Forest Research, USDA Forest Service, Pacific Southwest Research Station, March 2002, International Society of Arboriculture, Pacific Northwest Chapter P.O. Box 811; Silverton, OR 97381 (503) 874-8263 www.pnwisa.org

Benefits

The sum of all benefits was used to capture the value of all annual benefits (B):

$B = E + AQ + CO_2 + H + A$, where:

E = value of net annual energy savings (cooling and heating)

AQ = value of annual air quality improvement (pollutant uptake, avoided power plant emissions, and BVOC emissions)

CO₂ = value of annual CO₂ reductions (sequestration, avoided emissions, release due to tree care and decomposition)

H = value of annual stormwater runoff reductions (water quality and flood control)

A = value of annual aesthetics and other benefits

Costs

The sum of all costs. On the other side of the benefit-cost equation are costs for tree planting and management. Expenditures are borne by property owners (irrigation, pruning, and removal) and the community (pollen and other health care costs). Annual costs for residential yard trees (CY) and public trees (CP) were summed:

$$CY = P + T + R + D + I + S + C + L$$

$$CP = P + T + R + D + I + S + C + L + A$$

where

P = cost of tree and planting

T = average annual tree trimming cost

R = annual tree and stump removal and disposal cost

D = average annual pest and disease control cost

I = annual irrigation cost

S = average annual cost to repair/mitigate infrastructure damage

C = annual litter and storm clean-up cost

L = average annual cost for litigation and settlements due to tree-related claims

A = annual program administration, inspection, and other costs.

Average Annual Net Benefits

Net benefits. Net benefits are calculated as the difference between total benefits and costs ($B - C$). Average annual net benefits (40-year total/40 years) increase with mature tree size.:

- \$1 to \$8 for a small tree
- \$19 to \$25 for a medium tree
- \$48 to \$53 for a large tree

For the purposes of this plan the estimated average tree for Seattle was a (larger) medium-sized tree based upon the professional review and opinion of City arborists. Average net benefits were set at \$22 per tree.

Appendix B: Tree Regulations

This appendix lists City of Seattle planning documents, policies, programs and regulations that establish a framework for tree preservation, planting and care.

Item	Intent
Comprehensive Plan	<p>The City's Comprehensive Plan, <i>Toward a Sustainable Seattle</i>, is a collection of City-adopted goals and policies about how the City will accommodate growth. Notably, environmental stewardship is one of the four core values that shape the plan. The importance of trees in the City is evidenced by the numerous tree references throughout the plan.</p> <p>The significance of trees in our open spaces is recognized as an important element in creating the character of our neighborhoods, making our streets more pedestrian friendly, providing healthy spaces for our children, attracting development, and buffering different land uses. Protecting large and exceptional trees is specifically included in the policy to preserve and enhance the City's physical and aesthetic character and environment.</p> <p>Transportation policies include calling for the Transportation Strategic Plan to include design features such as "Green Streets" to support all transportation modes with an emphasis on pedestrian amenities, street trees and landscaping.</p> <p>The importance of open space, parks, and green streets are mentioned in all neighborhood plans. Additionally, six neighborhood plans specifically note the importance of trees including the need to seek additional tree planting opportunities (Bitter Lake), create opportunities for people to experience the natural environment through tree planting on private and public property (Crown Hill/Ballard), provide additional pedestrian amenities such as street trees (Downtown), enhance the health and quality of vehicle and pedestrian corridors by adding trees and other vegetation (Green Lake), provide streets that are green and tree-lined as well as encouraging development to provide trees and greenery (Greenwood/Phinney) and to mitigate impacts from arterials with measures such as street trees (MLK@Holly).</p>
Regulations	
DPD	<p>The following are summaries of regulations designed to protect and increase Seattle's urban forest. More detailed descriptions of these regulations can be found in Client Assistant Memorandums 242 and 341, which can be found at the DPD Website: http://www.seattle.gov/dpd/publications/client_assistance_memos_(CAMs)/</p> <p><u>Single-family: Tree Requirements</u> in Single-Family Zones. Subsection I of Section 23.44.008. Tree removal, retention and preservation are not regulated for existing built lots unless a tree is in a critical area. For undeveloped single-family lots, exceptional trees may be removed only in limited circumstances. Protection of other trees over 2 feet in diameter is encouraged. Tree preservation requirements cannot limit "development potential" and would be waived.</p> <p>This subsection of the Land Use Code requires that trees be planted or preserved when a new single-family residence is constructed. The code requires that, on most</p>

	<p>lots, 2 caliper inches of tree must be planted or preserved for every 1,000 square feet of lot area. For example, a 6,000-square-foot lot would be required to plant or preserve 12 caliper inches of tree. This requirement could be met by planting new trees, preserving existing trees, or a combination of planting and preserving. In addition, the requirement can be met on the single-family lot or by planting or preserving trees in the public right-of-way (street trees). When trees are proposed to be preserved, a tree preservation plan is required.</p> <p><u>Multi-family: Tree Requirements</u> in Lowrise Duplex/Triplex, Lowrise 1 and Lowrise 2 Zones. Subsection C of Section 23.45.015. Tree removal, retention and preservation are regulated for new development. This subsection of the Land Use Code requires that trees be planted or preserved when new multifamily dwelling units are constructed. The development standards are identical to the tree requirements for single-family zones, described above.</p> <p><u>Commercial: Setback Requirements</u> in Commercial Zones. Subsection C of 23.47.014 and 23.47.016.C. This subsection of the Land Use Code requires a 5-foot setback from all street property lines where street trees are required by subsection C of 23.47.016 and it's not feasible to plant them in ROW according to City standards.</p> <p><u>Commercial: Screening and Landscaping Standards</u> in Commercial Zones. Subsections B, C, and D 23.47.016. This subsection requires, among other non-related items, landscaping for new construction, street trees, and screening and landscaping standards for specific uses, such as parking lots and drive-in businesses. The following are required:</p> <ul style="list-style-type: none"> • Landscaping for new construction is required at a rate of 5% of the lot area. The landscaping is required to be in an area visible to pedestrians or customers and an area that has adequate sunlight and space necessary to ensure plant survival. No trees are required as part of the 5% landscaping requirement. The Director is often obliged to waive or reduce this requirement based on the building proposal. In most cases, a landscaped planting strip is all that's required. • Street trees are generally required for all new construction, and for significant expansions of existing buildings or uses, in commercial zones. The Director, in consultation with the City Arborist, may reduce or waive the street tree requirements if the trees would obscure the visibility of retail uses or obstruct pedestrian access to retail uses. • Landscaping standards for specific uses, includes general landscaping requirements for surface parking areas, drive-in businesses, outdoor storage, mobile home parks, and lots located within the shoreline. In general, these standards require landscaping but don't specifically require trees. <p><u>Director's Rule 13-92 (Landscaping standards, including trees)</u>. While the code specifies how much landscaping and trees are required for a given project, Director's Rule 13-92 specifies what types of landscaping and trees are required. The Rule establishes requirements for drought tolerant plants and trees, and lists when landscaping plans are required and what elements they should contain (e.g., common and botanical names, number of trees, number of shrubs, and quantity of ground cover required, etc.).</p> <p><u>Director's Rule 6-2001 (Exceptional and Heritage Trees)</u> The purpose of Director's Rule is to designate exceptional trees and Heritage Trees. This rule clarifies SEPA Plants and Animals Policy (SMC Section 25.05.675 N 2c.) for determining the value of outstanding trees on sites undergoing environmental review to establish appropriate tree protection mitigating measures. This rule also establishes a procedure for identifying Exceptional Trees under SMC Chapter 25.11.</p>
SDOT	<p>City of Seattle Board of Public Works Rules Chapter 4.3 describes beautification requirements within the street ROW area including permits, planting, maintenance, setbacks, and authority.</p>

Seattle Municipal Code	
	<p>Tree Protection Ordinance. Chapter 25.11 of the Seattle Municipal Code. Tree Ordinance (SMC Chapter 25.11). Tree protection on sites undergoing development, enforcement and penalties. The following is the purpose and intent of the City's Tree Protection Regulations:</p> <ul style="list-style-type: none"> • Implement the goals and policies of Seattle's Comprehensive Plan, especially those in the Environment Element dealing with protection of the urban forest. • Preserve and enhance the City's physical and aesthetic character by preventing untimely and indiscriminate removal or destruction of trees. • Protect trees on undeveloped sites that are not undergoing development by not allowing tree removal except in hazardous situations, to prevent premature loss of trees so their retention may be considered during the development review and approval process. • Reward tree protection efforts by granting flexibility for certain development standards, and to promote site planning and horticultural practices that are consistent with the reasonable use of property. • Especially protect exceptional trees that because of their unique historical, ecological, or aesthetic value constitute an important community resource; to require flexibility in design to protect exceptional trees. • Provide the option of modifying development standards to protect trees over 2-feet in diameter in the same manner that modification of development standards is required for exceptional trees. • Encourage retention of trees over 6 inches diameter through design review and other processes for larger projects, through education concerning the value of retaining trees, and by not permitting their removal on undeveloped land prior to development permit review.
	<p>Vegetation and Tree Removal Regulations for Environmentally Critical Areas. Environmentally Critical Areas Ordinance (SMC Chapter 25.09.320)</p> <p>This section of the SMC states that clearing or any action detrimental to trees or vegetation within environmentally critical areas is prohibited unless the Director has given prior approval to a restoration plan pursuant to buffer restoration, reduction, exemption, or exception provisions contained within Chapter 25.09, Regulations for Environmentally Critical Areas.</p> <p>The section also clarifies when vegetation and tree removal in critical areas needs a permit, and under what circumstances tree and vegetation removal in critical areas may be allowed by the Director of DPD.</p>
	<p>Safety, Fire Hazard or Nuisance Plants. SMC 10.52 Weeds and Vegetation Ordinance</p> <p>This ordinance regulates plants designated as weeds or overgrowth that are a safety or fire hazard or public nuisance.</p>
	<p>SEPA - Specific Environmental Policies for Plants and Animals. Subsection N of Section 25.05.675.</p> <p>This subsection states that plants living in the urban environment are of aesthetic, educational, ecological and in some cases economic value. Overall, the subsection</p>

	gives the decision-maker the ability to condition a project in order to mitigate the adverse impacts on rare, uncommon, unique or exceptional plant or wildlife habitat, wildlife travelways, or habitat diversity for species (plants or animals) of substantial aesthetic, educational, ecological or economic value.
Policy	
	<p>Parks and Recreation Policy. Parks Policy Number 060-P 5.6.1. “Tree Management, Maintenance, Pruning and/or Removal”</p> <p>Referred to as the “Parks Tree Policy”, this document identifies what can and cannot be done to park-owned trees. Some of the more important elements of the policy pertain to view relief, the development of “vegetation management plans”, the permit process for working on park-owned trees and specific areas of responsibility as pertains to park-owned trees.</p>
Programs	
	<p>Green Seattle Partnership The City has partnered with the non-profit Cascade Land Conservancy to restore and maintain the 2500 acres of forested parklands in Seattle that are in serious decline due to invasive plants such as ivy and blackberry. Community involvement is the key to the success of this ambitious 20-year program.</p> <p>Tree Fund Every fall the Department of Neighborhoods, provides trees to neighborhood groups to enhance the City's urban forest through the Tree Fund, a component of the Neighborhood Matching Fund. The City provides the trees, and neighbors share the work of planting and caring for the trees.</p> <p>Heritage Tree Program Trees that are unique as landmarks, or having exceptional characteristics or being associated with an historic building or event can be designated as Heritage trees.</p> <p>Community Stewardship Volunteer opportunities for planting and caring for trees and landscapes are available through Seattle Parks and Recreation (Parks) and the Seattle Department of Transportation (SDOT).</p>